THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIV. No. 1649.] LONDON, DECEMBER 18, 1894. [46TH YEAR. PRICE 6d.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
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Shipping Ports: All the principal Scotch Ports.

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Parker's Imperial Black Varnish,
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See Advt. p. 1184 of this week's issue.

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FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
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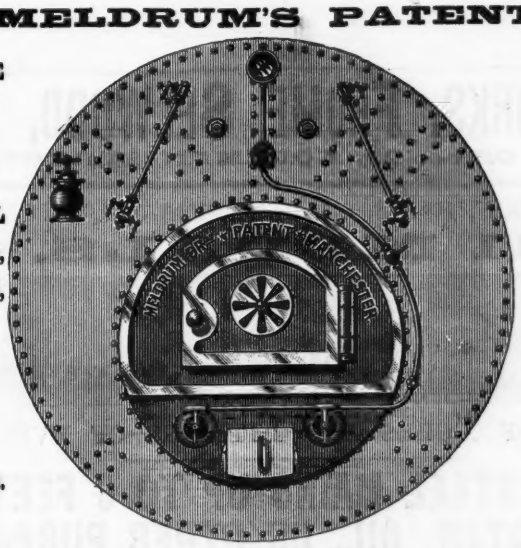

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(ESTABLISHED 1765),

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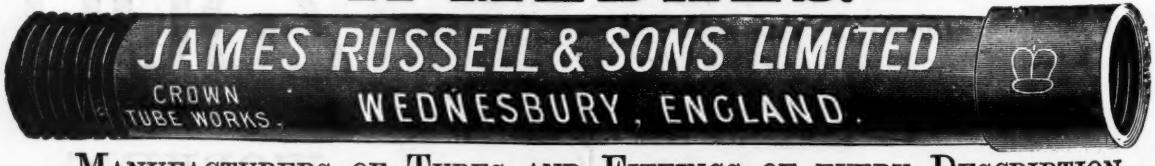

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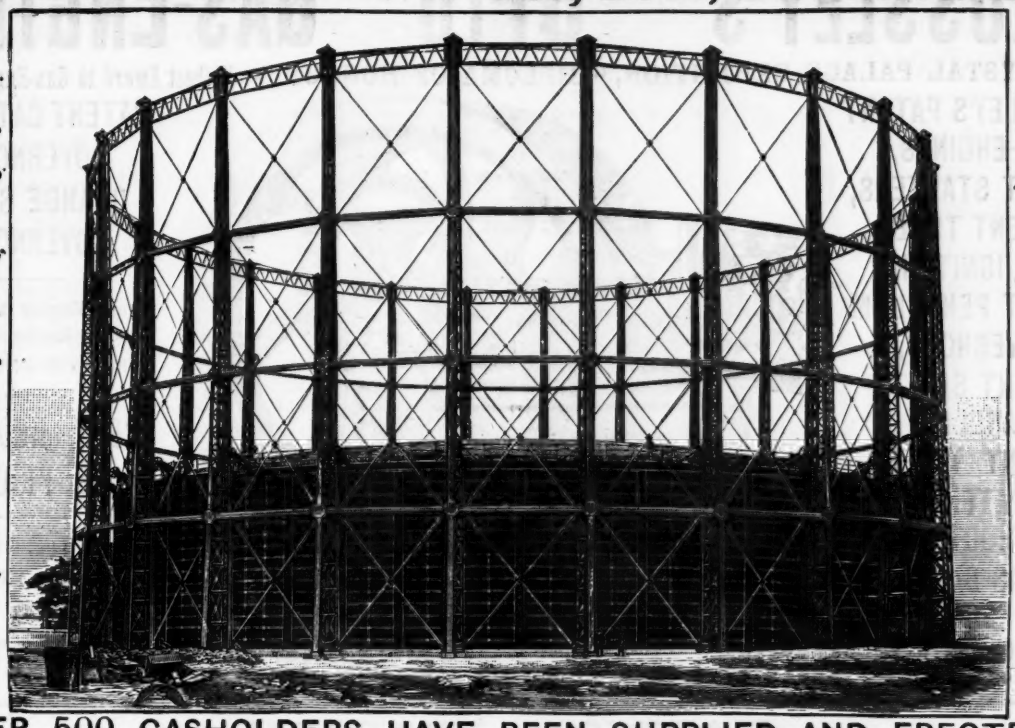

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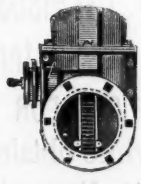

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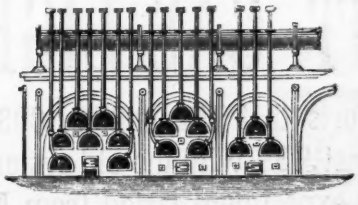

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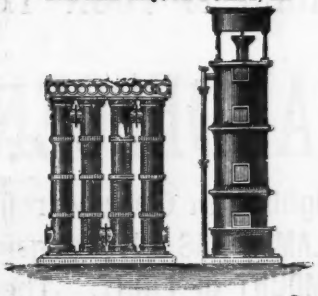

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for working Purifiers,

Also Bye-Pass & Stop Valves.

PURIFIERS with Planed Joints,

HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS.

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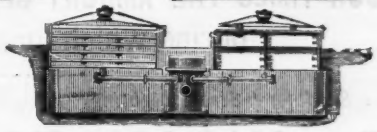

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Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

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CRYSTAL PALACE EXHIBITION, "DIPLOMA OF HONOUR"—Highest Award to Gas-Engines.

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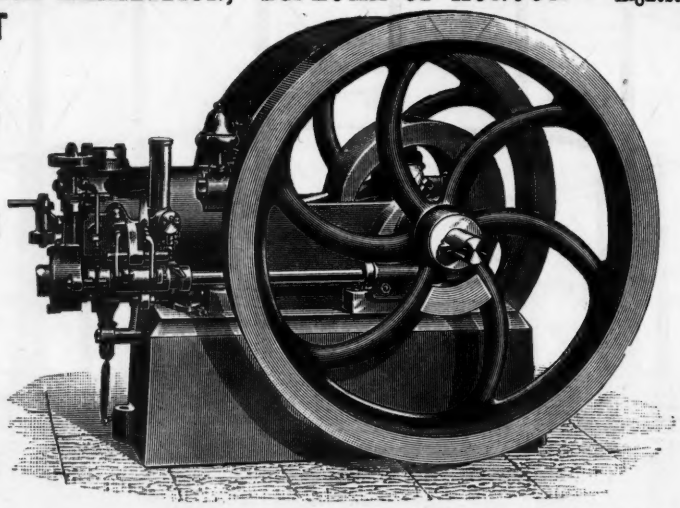

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Every Engine thoroughly tested before being sent out

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GLAZED BRICKS AND PORCELAIN BATHS.

TO GAS COMPANIES, CORPORATIONS, AND VESTRIES.

IMPROVED STREET LIGHTING

WITHOUT ADDITIONAL COST,

With THREE to FOUR TIMES the ORDINARY LIGHT,

CAN BE OBTAINED BY

THE INCANDESCENT GAS-LIGHT (Welsbach System)

The Inspector of Lighting in Glasgow reports that THE ANNUAL COST OF GAS FOR TEN INCANDESCENT GAS-LAMPS WAS £17, as against £39 with the old system, while obtaining FOUR TIMES THE AMOUNT OF LIGHT. The experiment lasted from May to November, during which time ONLY FOUR MANTLES WERE USED FOR TEN LAMPS.

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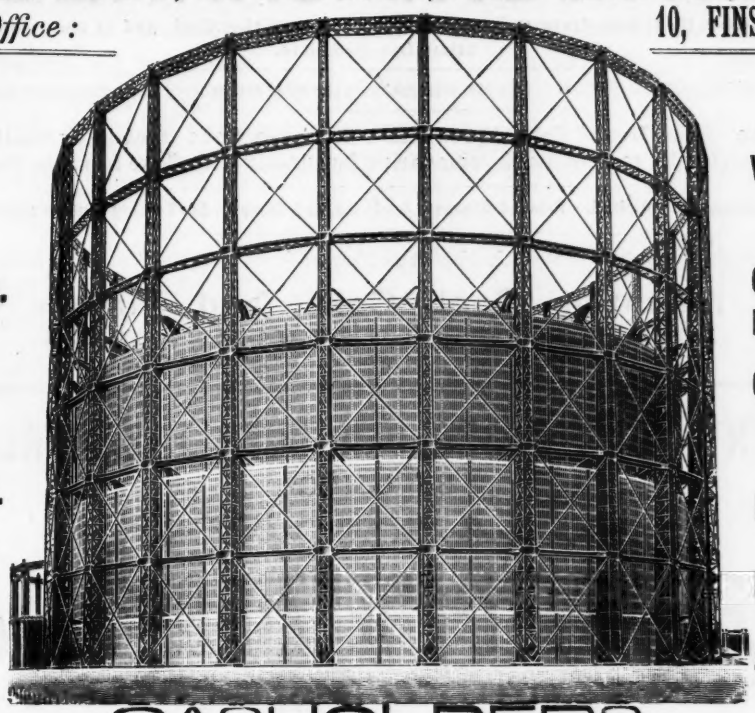
TOWER SCRUBBERS.

WECK'S PATENT CENTRE-VALVE.

CONDENSERS.

TAR PLANT.

SULPHATE OF AMMONIA PLANT.



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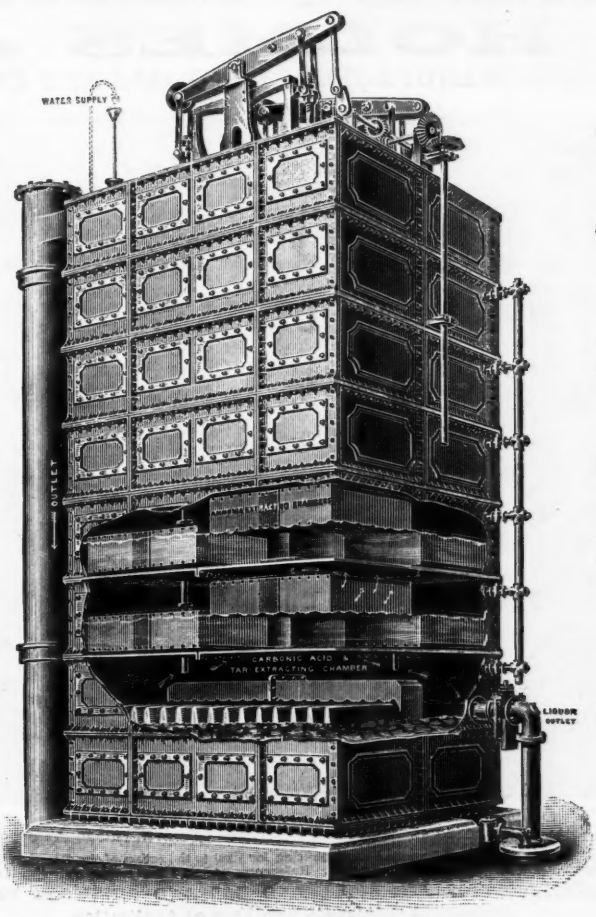
CONTINUOUS CARBONIZATION IN CLOSED RETORTS (ELLIOTT'S PATENT).

WALKER'S PATENT PURIFYING-MACHINE.

REMOVES ALL TAR & AMMONIA.

And from 40 to 50 per cent. of the Carbonic Acid and Sulphuretted Hydrogen.



REMOVES ALL TAR & AMMONIA.

And from 40 to 50 per cent. of the Carbonic Acid and Sulphuretted Hydrogen.

REMOVES ALL TAR & AMMONIA.

REMOVES ALL TAR & AMMONIA.

Taking the Whole of the Purification between the Condensers and Purifiers.

"BEAR CREEK"

The best **KENTUCKY CANNEL** in the Market.

SAMPLE CARGO will demonstrate the extraordinary value of this Coal, and of the resultant Coke and other Bye-Products.

The unlimited quantity and REDUCED PRICE of this Material makes it the most satisfactory and economical Gas Enricher now available.

COKE.—Briefly the "Bear Creek" Cannel produces a first-class Coke—that is, by itself, and unmixed with Coke from Common Coals—merchantable, comparing favourably with Coke from the Standard Gas Coals.

Correspondence solicited. Printed Reports, Analyses, and Samples for Testing sent on application.

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PREVENT YOUR GASHOLDER CUPS FROM FREEZING
BY USING
CLAYTON'S
IMPROVED ANTI-FREEZING APPARATUS

It is the CHEAPEST, SIMPLEST, and MOST EFFECTIVE in the Market.

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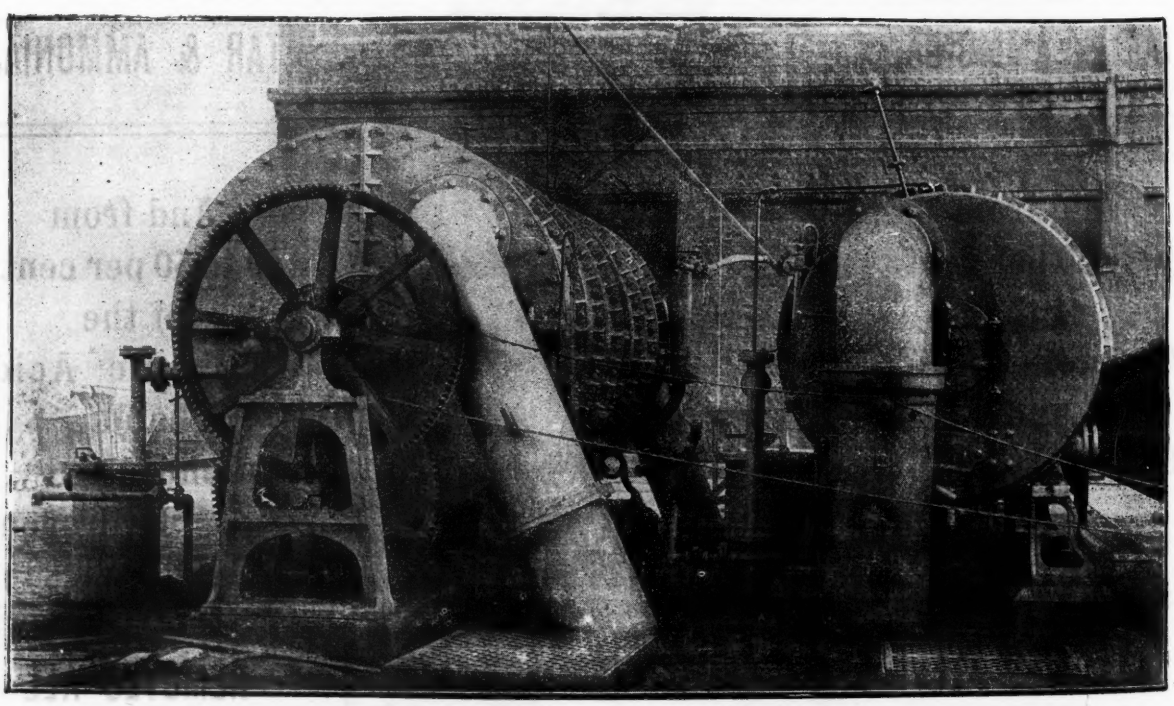
W. C. HOLMES & CO.,
CONTRACTORS, AND MANUFACTURERS OF GAS AND CHEMICAL PLANT.



IMPROVED PATENT SCRUBBER-WASHER as erected for the Corporation of Glasgow, and many other Corporations, Gas Companies, &c.
These Washers are guaranteed to present a larger area of wetted surface (size for size) to the action of the Gas than those of any other maker. Results are unapproached by any other system. References and full Particulars on application.
MAKERS OF GASHOLDERS OF ALL SIZES, AND GAS AND CHEMICAL PLANT GENERALLY.
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New Heating-Stoves for Winter Season, 1894-5.

The "Portland." 9401F.

A very elegant Fuel Fire, constructed entirely of Cast Iron, with fine Cast Ornamental Fret Panel, and Powerful Heating Chamber, and decorated with handsome Tiles in Fender.

Fitted with our **New Silent Duplex Burner, preventing the possibility of Lighting Back.**

Size: 20½ in. high, 18 in. wide, 12 in. deep.
Fire Space, 12 in.

Price - - - - - - 55s.

Can be fitted, if desired, with Tiles in top and bottom Panels, for 5s. extra.

The "Pagoda."

Hexagon-shaped Fuel Gas-Fire of chaste design and ornamental pattern. Made of Cast Iron, and fitted with Heat-Retaining Chamber, impeding the passage of the Fumes to the Flue, until the Heat has been taken up by the Tubes through which they pass.

Price - - - - - 40s.
In Ceramic Enamel - - 60s.

9401 Reflector-Stove.

A "Cheerful" Stove in all respects, and a great improvement on this class of Heating-Stoves generally, having a Tubular Wrought-Iron Heating Chamber, arresting the Heat, and imparting it to the Fresh Air circulating through the Tubes.

The Burner is fitted with Copper projecting Nipples, allowing freer play to the Air round the Flames.

Made in Cast-Iron and Polished Copper Corrugated Reflector.

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Ceramic Enamelled, in various colours, to imitate Majolica Ware, 50s.
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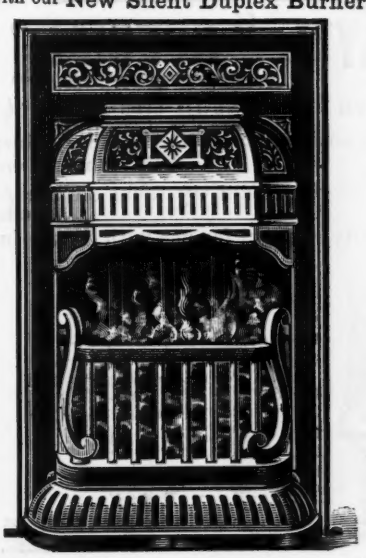
Register Interior, Fitted with Gas-Fire.

This Fuel Gas-Fire has been specially designed to take the place of an ordinary Register Coal Fire, and will be found very useful for small Flats, Bedrooms, &c.

It has a Heating Chamber over the Fire, gives out a great heat, and is fitted with our **New Silent Duplex Burner.**



Size: 30 in. high, 18 in. wide. Fire Space, 14 in.

Price, Best Berlin Blacked - - - 60s.

FACTORY & OFFICES: CAMBERWELL.

Show-Rooms: 59, QUEEN VICTORIA STREET.

All Communications to Camberwell.

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PATENT FLAT-FLAME LANTERNS,

From 30 to 1100 Candle Power.

THEY ARE SUITABLE FOR GAS OF EVERY CANDLE POWER,

MADE ENTIRELY OF COPPER.

THE "BRAY" REFLECTING LIGHT

Is an unequalled combination of SIMPLICITY, CHEAPNESS, and EFFICIENCY.

GIVES REMARKABLE LIGHTING VALUE FOR GAS CONSUMED.

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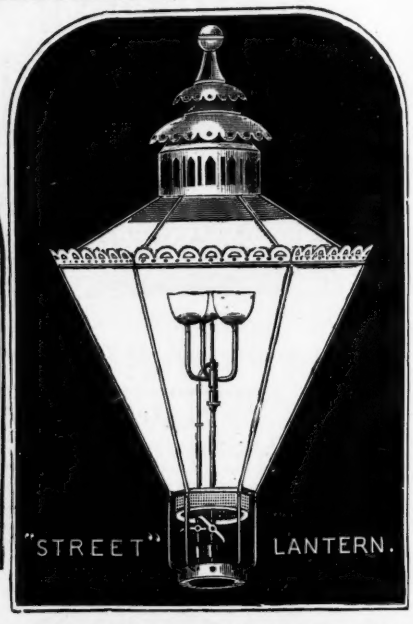


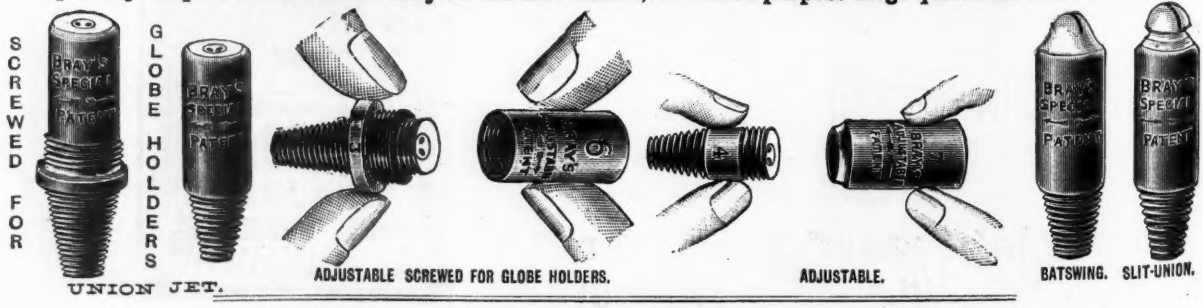
BRAY'S "SPECIAL" AND "ADJUSTABLE" BURNERS

Are the best in the Market for general use, and are very moderate in price.

It is not unusual to see the ordinary Burner yielding less than half the light that Bray's "Specials" and "Adjustables" would yield with the same consumption of Gas.

Gas Managers should try them on Consumers' Fittings; and they would see at once how to compete more effectively with the Electric Light.

Specially adapted for use with Penny-in-the-Slot Meters, for which purpose large quantities have been sold.



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GEO. BRAY & CO., GAS LIGHTING ENGINEERS, LEEDS.

R. LAIDLAW & SON,

GAS AND WATER ENGINEERS.

Manufacturers of **GAS APPARATUS** of every Description.

Makers in Glasgow of
CAST-IRON PIPES, ALL SIZES,
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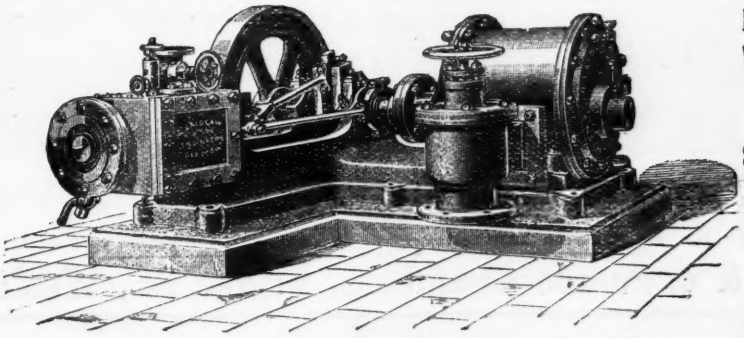
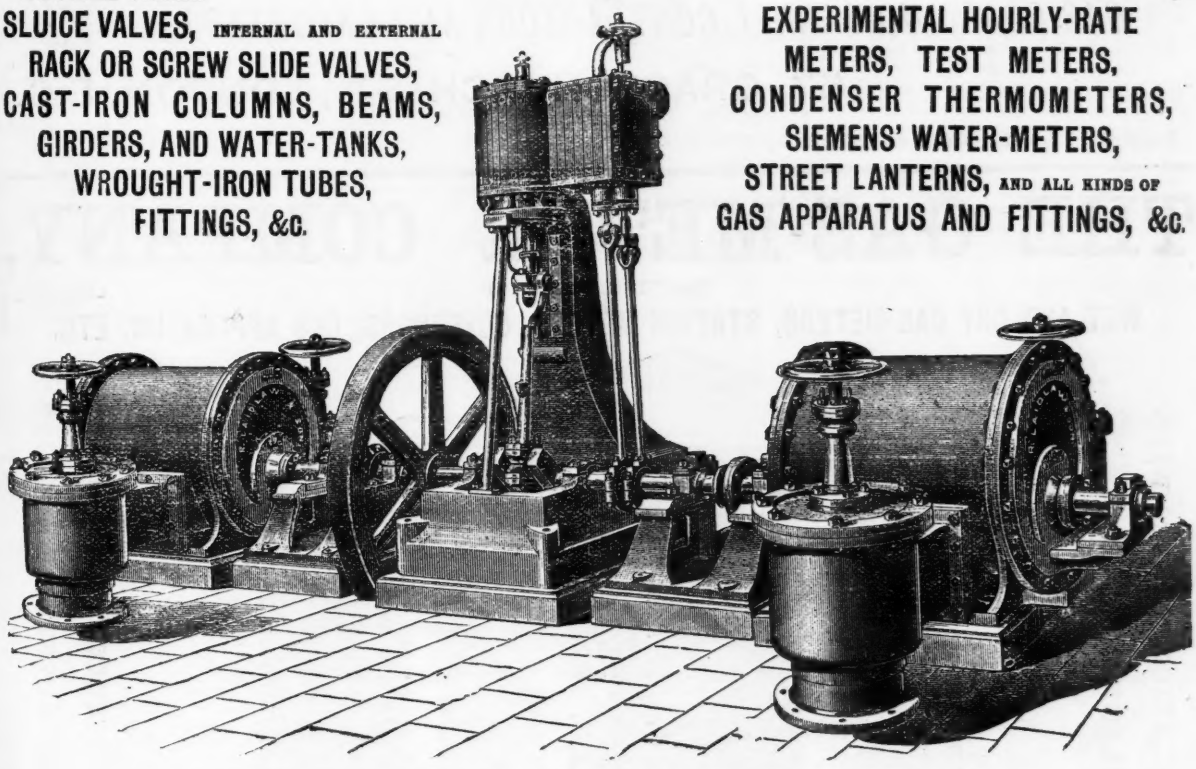
STEAM-ENGINES AND BOILERS,
PUMPING-ENGINES For Water-Works.
BEALE'S GAS EXHAUSTERS,
DOUBLE-FACED SLUICE VALVES, INTERNAL AND EXTERNAL
RACK OR SCREW SLIDE VALVES,
CAST-IRON COLUMNS, BEAMS, GIRDERS, AND WATER-TANKS,
WROUGHT-IRON TUBES, FITTINGS, &c.



BEALE'S GAS EXHAUSTER AND ENGINE COMBINED. All Sizes.

Makers in Edinburgh of
WET AND DRY GAS-METERS, IMPROVED
STATION GOVERNORS,
PRESSURE REGISTERS
PRESSURE GAUGES,
TEST HOLDERS,
EXPERIMENTAL HOURLY-RATE METERS, TEST METERS,
CONDENSER THERMOMETERS,
SIEMENS' WATER-METERS,
STREET LANTERNS, AND ALL KINDS OF
GAS APPARATUS AND FITTINGS, &c.



BEALE'S GAS EXHAUSTERS AND ENGINE COMBINED. All Sizes.

Prices, with full Particulars, will be given on application.

Two Gold Medals, One Silver Medal, One Bronze Medal, and Two Honourable Mentions,
INTERNATIONAL EXHIBITION, EDINBURGH 1886.

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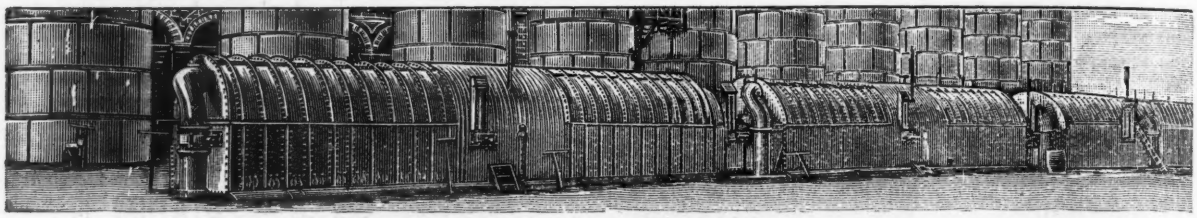
KIRKHAM, HULETT, & CHANDLER, LD.

PATENT "STANDARD" WASHER-SCRUBBER

☛ **484** of these Machines (capable of dealing with **464,490,000** cubic feet of Gas daily) in use which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company (the Engines driving same being under Galvanized Iron Covers). This Company have **30** of these Machines in use. They are also in operation at a great number of Gas and other Works in this Country and Abroad.

Sole Agents in Great Britain for Marshall's Patent Tar-Extractor.

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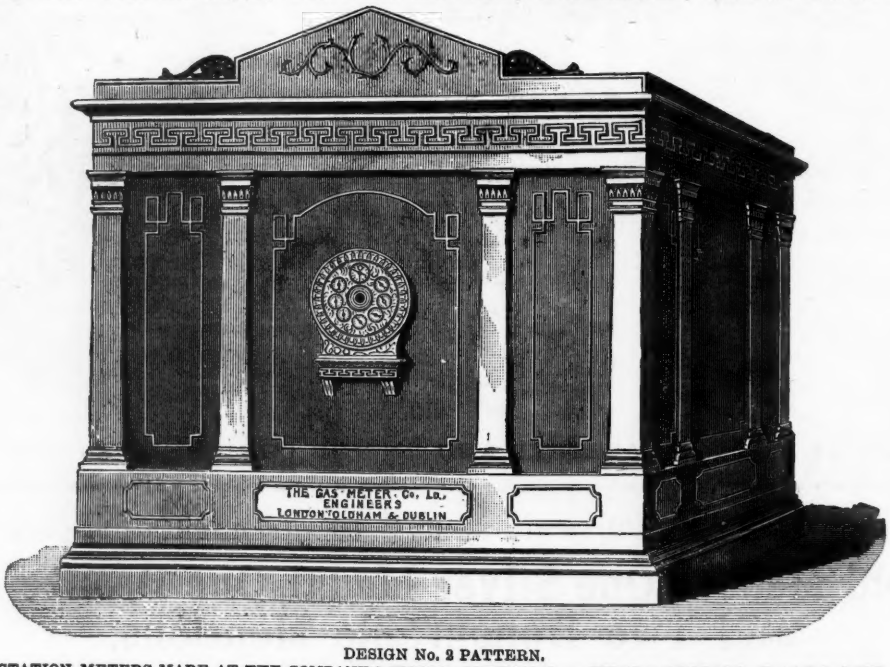
SQUARE STATION METERS WITH PLANED JOINTS.



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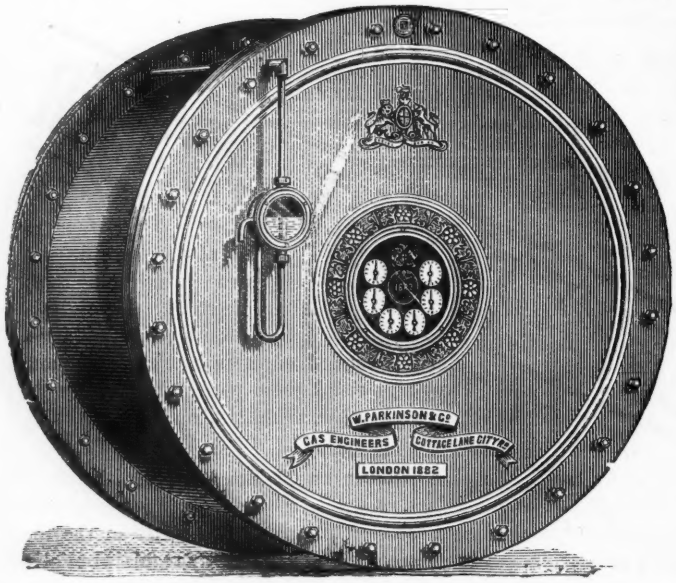

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[See also Advt. p. 1192.

CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE

"An Experimental Gas-Works" . . . 1157
The Law of Gas Companies' Responsibility . . . 1157
Another View of Gas Supply on the Continent . . . 1158
True Municipal Progress at Batley . . . 1158
Another Dublin Gas Lawsuit . . . 1158
Against Municipalization . . . 1159

WATER AND SANITARY AFFAIRS—
The London County Council and the Water Companies' Undertakings—The Transfer Bills Sanctioned . . . 1159
The Meetings of the Southwark and Vauxhall and Grand Junction Water Companies . . . 1159

ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 1160
Electric Lighting Memoranda . . . 1160
The Report of the Dutch Committee on Photometry . . . 1161
The Expenditure of Energy in the Production of Light . . . 1163

NOTES:—
The Estimation of Sulphur in Pyrites . . . 1163
The Direct Conversion of Calorific into Electrical Energy . . . 1163
The Preparation of Ozone . . . 1163

TECHNICAL RECORD:—
Society of Engineers . . . 1164
The Large Holder of the East River Gas Company . . . 1164
The Incomplete Combustion of Some Gaseous Carbon Compounds . . . 1166
A Systematized Photometrical Nomenclature . . . 1166

CORRESPONDENCE:—
Experimental Gas-Works . . . 1168
The Danger of Modern Gasholder Practice . . . 1168
Unaccounted-for Gas . . . 1168
The Meter System *v.* Inspection for Detecting Waste of Water . . . 1169

LEGAL INTELLIGENCE:—
High Court of Justice, Ireland—Exchequer Division—Alliance and Dublin Consumers' Gas Company *v.* The Corporation of Dublin . . . 1169
Court of Session—Bill Chamber—Magistrates of Falkirk *v.* Falkirk Joint-Stock Gas Company and Others; The Question of an Oversman . . . 1170
Shifnal Police Court—The Shropshire County Council *v.* The Wolverhampton Corporation; The Expenses Occasioned by "Extraordinary" Traffic . . . 1170
The Winding Up of the St. Ives Gas Company . . . 1170
Bradford Corporation *v.* Pickles . . . 1170
Claim for Damages Caused by Leakage of Gas . . . 1170
Damages against the Sheffield Corporation through the Negligence of Servants of the Water Department . . . 1170
A Property-Owner Fined for Allowing Water to be Wasted . . . 1171

MISCELLANEOUS:—
Meeting of the Continental Union Gas Company, Limited . . . 1171
Meeting of the Southwark and Vauxhall Water Company . . . 1172
Meeting of the Grand Junction Water-Works Company . . . 1173
The Plymouth Corporation and the Gas Company—The Testing of Gas; The Fumes from the Gas-Works . . . 1175
The Newark Corporation and the Gas Company—Contemplated Purchase of the Works . . . 1175
Electric Lighting Notes . . . 1176
Mr. W. R. Herring on Gas Consumption . . . 1176
The London County Council and the Water Companies' Undertakings . . . 1177
Notes from Scotland . . . 1178
Current Sales of Gas Products . . . 1179
Coal Trade Reports . . . 1179
Gas and Water Companies' Stock and Share List . . . 1179

PARAGRAPHS.—Mr. Geoffrey Drage, 1159—A Tax on Light in Italy, 1159—Death of Mr. C. Prior, 1159—Mr. A. H. Ward, 1161—Mr. G. H. Clark, 1161—Mr. T. Young, 1163—Mr. John Witten, 1163—Pan-Anglican Legislation, 1163—Official Changes in Connection with the East River Gas Company, 1163—Mr. H. T. Coles, 1164—Death of Alderman Faram, of Stoke, 1164—Gas Buoys in the Solent, 1164—Explosive Mixtures of Acetylene and Oxygen, 1164—Improvements in the Sheffield Corporation Water Distribution System, 1169—The Assessment of the Dudley Gas-Works, 1169—An Explosion at the Bakewell Gas-Works, 1169—Bilston Gas Company, 1169—Novel Means of Disposing of Superfluous Water at Sheffield, 1169—The Stourbridge Gas Committee and Gas-Works Loans, 1169—Coventry Corporation Gas Supply, 1171—St. Austell Water Supply, 1171—Further Trouble at the Eccup Reservoir of the Leeds Corporation, 1171—Reductions in Price, 1175—Sewage Disposal at Teddington, 1175—The Dewsbury and Heckmondwike Water Scheme, 1177—The Moneton (New Brunswick) Corporation and the Gas and Water Works, 1177—Plymouth Corporation Water Supply, 1177—Increased Use of Water-Gas Plant, 1178—Sales of Shares, 1178—The Condition of the Knaresborough Water-Works, 1178—Water in Western Australia, 1179—Concerts at the Midland Iron-Works, Donnington, 1179.

CHRISTMAS HOLIDAYS.

Owing to the CHRISTMAS HOLIDAYS, the next number of the JOURNAL will be published on Monday, Dec. 24. All communications intended for insertion must therefore reach the Office not later than the FIRST POST on SATURDAY, the 22nd inst.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 18, 1894.

"An Experimental Gas-Works."

THE brief letter by Mr. J. W. Helps, of Croydon, which appears in our "Correspondence" columns to-day, requires some notice at our hands. It is quite correct that the article on "An Experimental Gas-Works" to which the letter refers, was written and published without Mr. Helps's co-operation, and indeed without his knowledge. At the same time, it is only fair to him that we should make it clear that the credit for the suggestion which formed the basis of the article belongs to him. He threw out the idea, as we stated, at a meeting of the Southern District Association; and it struck us as so good that we have kept it in mind ever since, with the intention of taking the first convenient opportunity of sounding the industry generally as to its practical feasibility. This opportunity has now presented itself in the absorption of the Carshalton gas supply district into the Croydon Company's system, and the consequent abandonment of the Carshalton Gas-Works—which, of course, had not loomed upon Mr. Helps's horizon when he first spoke in favour of the establishment of an independent experimental gas company. It is desirable that this cardinal fact of the situation should be remembered, in order that the purely coincidental character of the circumstance that the opportunity for realizing Mr. Helps's suggestion has come about in his own neighbourhood, may not be misunderstood. Having made this point clear, it only remains to await developments, which, to be effective, must not be long delayed, because the works in question must soon be dismantled. Our idea is that the initiative of forming a company to acquire the Carshalton works—which could doubtless be done, by the good-will of the present owners, on exceptionally favourable terms—should be taken by gentlemen who, as gas proprietors, are interested in the development of the gas industry. That is to say, they should be gas company directors of the type in which happily the industry in the United Kingdom is rich—gentlemen of means and position whose interest in gas manufacture is something more than that of mere dividend-making. Names of leading men of this order will readily suggest themselves to many readers of these lines. Not much money would be required by way of capital to start the company; and if the Carshalton works can be bought at something like their breaking-up value, there would not be much risk of this being lost. It is for somebody who is more concerned in carrying out the idea than a technical journal can be, to formulate a scheme to this end; and we can only say that every help we can give to an acceptable plan, by way of publicity or otherwise, shall be forthcoming at the proper time. Perhaps the most hopeful way of ascertaining the feeling of influential gas capitalists and leaders of the gas engineering profession with regard to the idea would be to have an informal meeting for the purpose of discussing it in a non-committal way; and since the suggestion originated with Mr. Helps, it would not be pressing him unduly to leave in his hands the task of explaining how he now thinks it could be carried into effect. Somebody must do this, if anything is to come of the idea; and Mr. Helps has obviously thought more of the subject than anybody else. His reluctance to appearing officious in this matter will easily be understood; but he may rest assured that nobody whose opinion is worth anything in professional matters will misjudge his public-spirited motives in this regard.

The Law of Gas Companies' Responsibility.

AN important little case, serving to illustrate the law as to the responsibility of gas companies in regard to leaks occurring in those portions of their distributing plant which lie within consumers' premises, was decided by the Judge of the Bow County Court last Friday. It appears from the evidence, which will be found briefly reported in another column, that The Gaslight and Coke Company had fixed a meter for a butcher's shop, and the first night afterwards there was discovered to be a serious leak in what is called the Company's "main-pipe"—meaning, in all probability, the service on the Company's side of the meter. The fact was reported to the Company, who immediately attended to the matter. It was stated, however, that the escaped gas spoilt meat in the shop to the value of £20; and the Company were sued for the amount on the ground of negligence, which was alleged to consist in their having fixed the meter to a worn-out pipe. There does not seem to have been any dispute as to the facts; and the Judge held that there had been no negligence, as the Company attended to the defect as soon as they were made acquainted with it. If this had not been done, he said, there would have been negligence; but "there was no statutory obligation on them to discover a

"latent leakage when they put on a new meter." Judgment was accordingly given for the defendants, with costs. It was a hard case for the butcher; but doubtless the Judge is right. The judgment, nevertheless, is one that will not bear being subjected to a great amount of strain. The last case of a similar kind that has been decided by a Superior Court is that of *Jenkins v. The Hastings and St. Leonards Gas Company*, reported in the JOURNAL for Dec. 19 last year. Here a leak left in the Company's work by men who were proved to have fixed a meter in a hurry was decided to have been instrumental in setting fire to a builder's workshop; and so the Company were cast in damages. It seems a nice point to distinguish between the culpability of the degree of negligence that failed to discover a lighted gas leak, and of that which equally failed to detect an unlighted escape. Yet such has been done in these cases, since the Judge of the Bow County Court was satisfied that no responsibility for discovering a "latent leakage" rested upon the Gas Company. It is idle to inquire what would have been held if, instead of spoiling a tradesman's stock, as was alleged in the Bow case, the escaped gas had accumulated, and resulted in a disastrous explosion and fire; for presumably the Company should have been held blameless whatever the consequences of the defect in the service. All the same, there is the record of the Eugenia Road affair to create the impression that Courts of Law are occasionally impressed by the "poor sufferer" and "wealthy company" plea.

Another View of Gas Supply on the Continent.

SEVERAL of the leading points of the recent experience of the Imperial Continental Gas Association in regard to the position and prospects of the gas industry on the Continent are again prominent in the report of the Directors of the Continental Union Gas Company, which was presented at the meeting held last Tuesday under the presidency of Sir Julian Goldsmid. The principal business centres of the Continental Union lie to the southward of those of the former undertaking, speaking generally; and consequently their circumstances differ in some important respects, apart from questions of latitude. Yet we learn that the experience of the Continental Union Company and its allies is of an increasing use of gas for public lighting, and of a growing private *clientèle*, in connection with which, however, the consumption of gas does not keep pace with the additions to the number of burners recorded. The explanation of this circumstance is, of course, to be found in the constantly increasing use of improved burners, which is in itself a gratifying and promising fact for the industry. In addressing the proprietors, Sir Julian Goldsmid was justified in claiming, as he did, that the affairs of the Company are now on a sound footing; and he very rightly drew the attention of his audience to the gravity of the proposal of the Italian Finance Minister to impose a further tax on gas. It is greatly to be feared that the Italian Government will carry this proposal, because the hopeless impecuniosity of the State would drive them to tax the sun itself if they could get at it. How business is to be carried on in this absurdly overweighted nation is becoming day by day a problem of greater gravity. As Sir Julian Goldsmid observes, when Italian Ministers talk of economies to be effected in the public administration, it is always to the accompaniment of some proposal for increased taxation. All commerce is taxed and re-taxed and sur-taxed in that country until it is on the point of being suffocated. Gas, of course, is taxed by every Municipality where it is supplied; and it would be a marvel that it should be burnt at all if it were not known that all lighting oil is similarly burdened. The doubtful future of Italy is, in truth, one of the few clouds that rest upon the Continental Union and the other Gas Companies doing business there.

True Municipal Progress at Batley.

THE Corporation of Batley are to be congratulated upon their resolution, reported in last week's JOURNAL, to cease the indirect taxation of the consumers of Corporation gas. This is something like "progress" in municipal politics. It must have been a piece of sharp self-denial on the part of the Batley Town Council to forego the £2000 a year which has been collected from the gas consumers in aid of the rates of the town. But the Gas Committee have "seen the red light," as some of their constituents might express it, in evidences of a growing disinclination of the largest consumers to support the town gas-works; and they have taken the heroic course of reducing the price of the gas by 4d. per 1000 cubic feet, which means practically selling it at cost price. Of course, it is said by one party in the town that the gas-works are the property of the ratepayers, who have invested £160,000 in the undertaking, and are therefore entitled to receive a fair and adequate return for their money. This consideration, however, has not prevented a number of the same ratepayers from taking to other means of lighting for their own selfish reasons, on the score of the dearness of the town's gas, while leaving those who do consume this illuminant to relieve them of a share of the burden of the rates. This behaviour on the part of a handful of large ratepayers has been most effectual in opening the eyes of the Batley Gas Committee to the folly of their past policy; and they have judiciously followed the only course open to them for "getting level" with the parties in question. Henceforward in Batley those ratepayers who do not burn gas will not be helped out of the pockets of those who do. And the cheapness of the gas supply will force it into increased demand for all purposes. With regard to the supposititious claim of the ratepayers for what is styled a fair and adequate return for their money, they must look for it in the form of cheap gas. It is a mere delusion to suppose that the obligation, such as it is, can be fairly acknowledged in any other way. Not one penny of the capital needed for the purchase of the undertaking ever came out of a ratepayer's pocket; and it is a sheer absurdity to pretend that, as a ratepayer, a single inhabitant of Batley has a right to a farthing from the gas profits. If such a right existed, the Corporation could no more abrogate it by merely passing a resolution than they could by the same means equip the Town Hall with wings, and then make it fly round the town. We shall mark with much interest the experience of the Corporation with their cost-price gas business; and, meanwhile, we felicitate the Gas Committee on having at last "put the saddle on the "right horse" in the matter of rating.

Another Dublin Gas Lawsuit.

ANOTHER chapter in the stormy history of the relations between the Dublin Corporation and the Alliance and Dublin Consumers' Gas Company has to be recorded. As will be seen by the report which appears in another column, the Company have had to sue the Corporation in the Irish Exchequer Court for an amount of £308, being a charge for work done and materials supplied in connection with alterations and repairs of the public lighting plant of the city, extending over a period of three years and four months. The charges were of the same character, and made for the same services, as must have been paid for over and over again in the past; being simply the cost of moving street-lamps, and repairing them when broken. The Corporation apparently cannot live without fighting the Company; and so they worked up a very pretty quarrel over this bill. When the Company took steps to recover the money, the Corporation paid £32 into Court, and pleaded as to the rest that the work was to be done free of expense by the Company because it was ordered "on the ground of public necessity." The case lasted three days, during which it wandered all over the law and practice of public lighting, with several excursions into personalities; and it ended as it only could end. First of all, the Judge decided that the Company's charges were legal ones; and then the jury were asked to say if they were reasonable. This they did in due course; and the plaintiffs then obtained their verdict for the full amount claimed, with costs. Once more, therefore, in their incessant litigation with the Corporation, the Company have been successful. One would think that if there yet remained a gleam of the sense of humour to the members of the Corporation of Dublin, to say nothing of a remnant of the sense of justice and of business quality, they would be tired of paying law costs for the pleasure of keeping up a ridiculous position with regard to the Company. There is still reserved, as between the litigants in this case, the point of law as to the bearings of clause 24 of the Gas-Works Clauses Act, 1871, which is embodied in the Company's Act, upon the subject-matter of the dispute. For ourselves, we cannot see that the clause has any bearing at all upon the matter generally; but there is (of course) a question respecting some few of the Company's charges, which has been submitted to Counsel, who has advised that it should be raised for argument

before the full Court. The charges to which the question refers may perhaps amount to £20 for the whole period included in the account; and to settle it may cost £200 or more. But what of that? Must not the young and old ravens of the Irish Bar be fed? Must not the Corporation have their knife into the Gas Company? It is only a base commercialism, foreign to the fine spirit of the patriots who at present constitute the Corporation of Dublin, which weighs such trifling considerations as that of law costs, especially when the money has to come from the ratepayers and the gas consumers.

Against Municipalization.

One of the most powerful denunciations we have ever read of the modern idea which favours the municipalization of enterprises hitherto left to private initiative, appears in a recent issue of the *Electrician*, and is indited *à propos* of the revelations respecting the municipalization of the Manchester Ship Canal and the Ribble Navigation referred to in these columns on the 4th inst. After showing that, on the face of the scheme, the London County Council would have been justified in sinking the ratepayers' money in the attempt to supply electric light to all London from Deptford, our contemporary observes that "when a municipality steps outside the straight path "of parochial utility, and, by a majority may be of one, "involves the credit not only of *all* of its constituents "then existing, but of many future thousands in purely "commercial, largely speculative ventures, such as gas "vending or electricity vending, a 'magnificent sample "'of municipal enterprise' may very well become a "piece of injustice." It is one thing, the argument continues, to apply the power of a small majority of the governing body to the carrying of necessary measures of sanitation, police, and so forth; but it is quite another story when, whether he likes it or not, burdens are clapped on to the ratepayer "to aid local busybodies to set up "business in gas, electricity, or other similar condiments "of modern urban life." We should not, perhaps, call gas a "condiment," or even a sweetmeat, of town existence. But certainly electric lighting is proving itself a pretty powerful emetic to the town councillors of Londonderry and of one or two other "progressive" places; while it must be poison to many unfortunate shareholders in electrical schemes. Our contemporary meets an objection that would readily occur to the believers in municipal gas manufacture, who might urge that so far gas has helped the rates, instead of being helped by the ratepayers, by arguing that "the mere fact that a venture of "this nature frequently pays, does not alter the principle "for which we contend, although, of course, a municipal "milk supply which should reduce the rates by a hand-"some amount would not, as ratepayers are constituted, "lead to many searchings of heart connected with such "academic questions as the expediency or propriety of "the undertaking." We fear it is too late to set the clock back to the time when local authorities confined themselves to what the *Electrician* terms "the straight "path of parochial utility;" and the best that can now be hoped for is that whatever other paths our municipalities may be tempted to follow may be equally "straight."

Mr. Geoffrey Drage, whose excellent work as Secretary of the Labour Commission has been frequently alluded to in the Journal, has, we learn, accepted the position of Secretary to the Liberty and Property Defence League.

A Tax on Light in Italy.—In the course of his financial statement in the Italian Chamber of Deputies on Monday last week, the Minister of the Treasury (Baron Sonnino) announced that a sum of 27 million lire would have to be provided for by increased taxation; and among the means proposed for raising this amount was a small tax on the consumption of gas and the electric light by private persons.

Death of Mr. C. Prior.—We regret to announce the death of Mr. C. Prior, the Secretary of the Hoddesdon Gas Company, which took place at his residence, at Broxbourne, on Monday last week. Mr. Prior had held office from the formation of the Company in 1847; and during this long period he had only been absent on two occasions from the monthly meetings of the Directors. He was a man of strong character and good business ability—having held most of the honorary offices in connection with his district; and he was for many years a Guardian of the Ware Union, and a member of the Rural Sanitary Authority. He was 74 years of age. The interment took place in Broxbourne Churchyard on Saturday, amidst tokens of sympathy and respect.

WATER AND SANITARY AFFAIRS.

At their meeting on Tuesday last, the London County Council passed a series of resolutions approving the eight Bills, of which statutory notice has been given, for the transfer of the undertakings of the Metropolitan Water Companies. The rejection of an amendment brought forward by Mr. Campbell, that only one Bill should be proceeded with at present, is not a matter for regret. For the Council to obtain one undertaking would be eminently unfair to the remaining seven; and it would be a very inconsistent course on the part of the Council, who claim to be installed as the sole Water Authority of the Metropolis. There is an idea that if a decision is obtained on one Bill, it will settle all the rest. This may be true; but if all are to be settled, all should be heard. Mr. Westacott says there are not to be eight fights, but one. Yet we apprehend that this one must be a combination of eight. If all the Companies are to stand or fall by the fate of one of their number, they will be taken at a disadvantage. However, the question of procedure is one for the Select Committee to decide. But the appearance of these eight Bills looks rather like an attempt to separate a force that should be united. The Companies will have to be on their guard, lest they are taken in flank by the Council. The plan adopted on this occasion is both cumbrous and costly, and stands in contrast to the scheme brought forward in 1880 by the present Lord Cross. Then all the details of purchase were settled beforehand, and were embodied in one measure. If the present Bills are carried, eight negotiations will ensue, to be followed, in all probability, by eight arbitrations, with enormous costs attached. If "fair and reasonable terms" of purchase were really all that the Council desired, this tortuous method need never have been attempted. In the debate last Tuesday, Mr. Bassett Hopkins is reported to have said "it was generally felt that the Companies would "not agree to a transfer at the price which the Council "would be prepared to give." The conditions of arbitration which are contained in the Bills sufficiently show this. Mr. Westacott, speaking after Mr. Bassett Hopkins, contended that "the Council could only hope to secure the "undertakings by paying full compensation." This is all the Council ought to hope for; and we trust it is all that Parliament will give them. Mr. Beachcroft has asked what is to follow if the Council get their eight Bills through Parliament. Is there to be a new supply in addition to the old? According to a report which comes before the Council to-day, "two sets of surveys" are requisite in connection with a scheme which the Water Committee have under consideration, and a request is made for a second sum of £450 on this account. "The "question of supplementary supply" is held to be "an "integral part of the general problem."

Alderman Sir H. E. Knight, as Chairman of the Southwark and Vauxhall Water Company, had to deal with a somewhat complicated balance-sheet in his address to the shareholders at their half-yearly meeting last week. But all was made clear; and the complaint uttered by Mr. Jeffries, that the dividend might have been at the rate of 6½ instead of 6 per cent. per annum, was perhaps rather encouraging than otherwise. There is a good balance to be carried forward, and this will help the next dividend. Certain matters beyond the control of the Directors act in diminution of profits; while other causes happily tend to augment the revenue. Among the adverse influences, there is the perpetual rise in rates and taxes. These were high enough in the year ending March last, when they burdened the Company to an extent exceeding £23,000. Following this, the charge for the last half year is not far short of representing £25,000 per annum—the increase for the six months being £760; provoking the remark from the Chairman that this "old enemy," in the shape of rates and taxes, became more formidable each time he addressed the shareholders. In addition, there is now an increased yearly payment to the Thames Conservancy to the extent of £1400, one-fourth of which amount enters into the present accounts. Henceforth the Company will have to contribute about £4400 per annum to the funds of the Conservancy; and still there is ground for congratulation in the circumstance that a yet heavier payment has been escaped. Even the Companies do not get water for nothing; and, after they have got it, there is the necessity of pumping every drop, besides filtering the

whole volume, after which there is the process of distribution. "Free water for the people" will never exist, unless the people go and fetch it for themselves. Companies also have to encounter bad debts; and the Southwark and Vauxhall Directors find that out of nearly £1000 which at one time they expected to receive on outstanding accounts, as much as £700 must be written off as hopeless. Yet the Companies are often described as having the consumer by the throat, so as to exact the uttermost farthing. A singular feature in the balance-sheet consists in the fact that the half-yearly revenue to September shows a slight decline compared with the corresponding half of 1893, though there is a good advance on the six months ending last March. The recent wet summer is said to have injuriously affected the proceeds of the meter supply; the deficiency on that account exceeding £1400. With so large a reduction in this direction, it is evident that there must have been a considerable addition from new houses; and this again is proved by the increased quantity of water which has been pumped. On the whole, the good management of the Directors and their staff has produced what the Chairman describes as "a very successful "half year;" leaving £65,606 to carry to the transfer of profits account, as against an amount less by £1165 a year earlier. One element contributing to this success consists in a reduction of £1160 in the charges for maintenance, as compared with a year ago. On three leading items the total saving has been no less than £2500; but the extra expenditure for pumping, together with the enlarged contribution to the Conservancy and the increase in rates and taxes, has left less than £1200 to the good. Satisfaction is also expressed at the manner in which the Select Committee of the House of Lords dealt with the Bill promoted by the Company last session; the virulent opposition of the London County Council proving of none effect.

At the half-yearly meeting of the Grand Junction Water Company on Wednesday, the Chairman (Mr. Francis Tagart), situated very much like Sir Henry E. Knight, spoke of the slow increase in their water-rental, and the material advance in rates, taxes, and the Thames Conservancy charges. In respect to the last item, some kind of set-off is acknowledged in the circumstance that the Water Companies will henceforward have one representative at the Conservancy Board. The Grand Junction Company have the more reason to be gratified with this arrangement, seeing that one from their own ranks—Mr. Tendron—has been elected as the representative member. Concerning the future of the Metropolitan Water Supply, we find Mr. Tagart expressing a desire that the Companies taking water from the Thames would combine to carry out a comprehensive scheme of storeage, "upon the lines indicated by the Royal Commission." Here we would observe that the situation is somewhat altered since the Royal Commissioners drew up their report. "The lines" are in one respect occupied by the scheme for which the Southwark and Vauxhall Water Company obtained the sanction of Parliament in the late session. If the Grand Junction Company can initiate a movement which shall strengthen the position of the Companies, it will be well; for at present there seems some incongruity in providing increased storeage without the power to abstract more water from the river. There is a sort of haze hanging over this question which is not satisfactory. The letter of the law is being broken, for the simple reason that this is a lesser evil than leaving London with a deficient supply of water. The law should be brought up to the level of the necessity; but we may suppose action is suspended in view of what the County Council are attempting. Mr. Tagart's estimate of the parliamentary situation is confidence in the sagacity of the Legislature, and distrust as to what is intended by the scheme of "arbitration" set forth in the "transfer" Bills. In the discussion which followed the Chairman's speech, Mr. Tendron spoke with much force on the subject; protesting against the "audacity" of the County Council in presuming to give absolute instructions as to what the Arbitrators are to do. He placed the subject on its true pivot when he said the question of value did not relate to the price of "mere iron, pipes, and engines," but comprehended the "earning power" of the Companies. This is a consideration which the Council have steadily ignored throughout. They are aiming simply at the income; and it is for this they must pay.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1179.)

THE week just concluded on the Stock Exchange opened quietly; and business remained, for the first day or two, rather dull and hesitating. But a better tone then set in, with more activity, and a decidedly improving tendency; so that, on the whole, prices all round closed at an advance on the opening figures. The indomitable gilt-edged division were again foremost in the advance; and, as an example, it may be recorded that Consols were done on Saturday at 103⅜ *ex div.* The improvement was shared, to a moderate extent, by the inferior classes; even the depressed American having a brighter turn, while the more speculative lot—such as "Kaffirs"—were very buoyant. In the Money Market, the plethora seems worse than ever; and, when anything good is offered, a rush is made for it. A modest issue of debenture stock, invited by the East London Water Company, was applied for ten times over; and one applicant was content with a return of £2 13s. 4d. per cent. for his money. In the Gas Market business has been very steady; and prices are still creeping up with regular steps. Gaslight "A" was fairly active—prices taking a somewhat wider range than has recently been the rule; but the selling price is one point better. The secured issues are quieter; and higher prices are asked—all the debenture stocks being quoted at a good advance *ex div.* Business in South Metropolitans was less extensive. But a few lots changed hands at choice figures; and the "B" is quoted 2 higher. One or two transactions in Commercial were marked at top price; but the nominal quotation remains unchanged. The Suburban and Provincial division were as lethargic as usual; but their market values are still improving. Of the Continentals, Imperial and European were steady and unchanged, but Union (which met on Tuesday, and declared their usual 13 per cent. dividend) was in good force, and made a substantial advance. The more remote undertakings were generally in good favour. Bombays recovered their position; and Malta made a fractional advance. The quotation of Buenos Ayres was opened out to a wider margin. Transactions in the stocks of the Water Companies were extremely limited, even for that quiet market. But prices in general are still on the rise; and several quotations have made a fair advance.

The daily operations were: The Gas Market opened very quiet; and business was restricted all day—quotations being unchanged, except for an advance of ½ in Gaslight "A." Tuesday was quite as inactive; and the only alteration was an increase of ½ in Alliance and Dublin. Transactions still remained very much limited on Wednesday; and again quotations underwent no change. On Thursday, there was a little sign of reviving activity, and prices were good; but still the nominal figures continued as they were, except where *ex div.* adjustments produced an advance. New River Water rose 1½. Friday at length brought about more dealing; and quotations rose. Gaslight 6 per cent. debenture advanced 2½; South Metropolitan "B," 2; Brighton, 2; and Bombay old, ½. Saturday was very quiet; but some few advances were made. Bombay new rose ¼; and Chelsea Water, 2.

ELECTRIC LIGHTING MEMORANDA.

The Board of Trade and Transformer Chambers—A Warning to Local Boards—The Progress of the Woodhouse and Rawson Liquidation—A Lesson from Deptford.

THE Board of Trade inquiry into—or, more strictly speaking, conference upon—the location of electric transformer chambers mentioned in this column last week, was held on Thursday, under the presidency of Sir Courtenay Boyle. The London County Council and several Vestries, and the electric lighting companies were strongly represented on this occasion, which was felt to be of great importance by all the parties concerned. For the public authorities it was contended that Parliament, in sanctioning the placing of electric cable junction-boxes beneath the streets, never contemplated the extension of this privilege for the much larger affairs now known as transformer chambers. It was furthur argued that the existence of these cellars under the public streets would constitute a great danger, inasmuch as they could not be made and kept water-tight, and there would consequently be a risk of their accumulating gas and water, with the inevitable results of electrolysis and explosions. Sir Courtenay Boyle took this view, so far as saying that, according to his view, the statutory permission to construct junction-boxes in the streets does not cover transformer chambers; and having arrived at this point, the conference adjourned for a week in order that some suggestions might be formulated for rendering the chambers unobjectionable on the score of public safety. Previous to the conference, a meeting of the Electrical Trades Section of the London Chamber of Commerce had been held, to consider what should be done in the matter; and it was resolved that, in the opinion of the Section, there would be no danger in putting transformer chambers in the streets, and that these chambers can be so constructed as not to form any serious obstacles to the future use of the public thoroughfares for other

necessary purposes. The electrical interest will now have an opportunity for supporting this view before the Board of Trade; but the fact of the point of law having been decided against them puts at a great disadvantage the electric lighting companies whose system needs transformer chambers.

A remarkable episode in the history of the dealings of local authorities with the electric light has developed itself at Prescot, where the Prescot Wire Company have an installation, and are under contract with the Local Board to light the public streets. A solicitor in the town had had to complain of the inefficiency of the electric lighting; and he took the trouble to bring the contract under the notice of the Local Government Board, on account of the fact that there is no penalty clause in it, which renders it illegal. There appear to be two parties in the town and in the Local Board—one in favour of electric lighting, and the other of gas; and there has been much heated local controversy on the subject. Meanwhile, it had come to be minuted several times in the official records of the Local Board that the electric lighting was not satisfactory, notwithstanding which circumstance payments amounting to £360 were made to the contractors by means of cheques signed by four members of the Board. Acting upon these minutes, the Official Auditor has now decided that this money ought not to have been paid; and he has surcharged the four signatories with the full amount. This action has very naturally caused considerable commotion in the town; and the Clerk to the Board is preparing a petition to the Local Government Board, asking that the surcharge may be remitted. Comment on the story would spoil it.

A meeting of the Woodhouse and Rawson debenture-holders was held on the 11th inst. to receive a statement by the Receiver and Manager as to the progress made in the realization of the assets. The story told by this official was of a most depressing character. He found everything at "sixes and sevens;" and it took many months to get the books into shape, and ascertain the condition of the estate. This must have been a big job, for the Company had branches to the number of thirteen in the United Kingdom, besides others on the Continent and in the Colonies. As all these branches not only traded with the head office, but also amongst themselves, it was necessary that all the books at all the offices should be written up before the assets could be traced. While this was being done, there were contracts in hand to be completed; and it had to be decided what branches should be carried on for the benefit of the estate. The Receiver found he had to begin his trading with overvalued stocks; and after a year's work he found he had made a loss of nearly £4000, the greater part of which was accounted for by the fact that the turn-over was nothing like large enough to bear the standing charges, although everything was done to cut down expenses. The Court was communicated with; and, as the result, directions were given to close down the head office and branches. Consequently, trading has now altogether ceased. As for the assets, the depreciation has been enormous; but the details cannot be gone into here. It is sufficient to state that, in the Receiver's words, "the realization of these assests has fallen far below the too sanguine estimate placed upon them by the Directors." It results from this that in no case can even the debenture-holders receive a return in full for their investment.

Discussing the subject of municipal enterprises generally, on the text supplied by the article in *The Times* referred to in our editorial columns on the 4th inst., the *Electrician* offers some remarks upon the policy of local authorities undertaking to supply electric light, which enthusiastic advocates of a "forward" movement in this respect would do well to study with care. Our contemporary is by no means of opinion that it will be to the ratepayers' advantage for municipalities generally to go deeply into the "more or less speculative business" of electric lighting; and such a declaration is more to be regarded than reams of fulsome reports emanating from consulting electricians on the look-out for fat fees. It is pointed out that "the electrical analogue of the Manchester municipal canal and the Preston municipal docks would have been for the London County Council to have undertaken the electric supply of all London from Deptford. What this premature Colossus has come to we all see to-day." But it is truly said that, until the event decided the question, the arguments for this scheme were just as cogent as the croakings against it were alarming. "Indeed, taking one consideration with another, as the poet says, an ambitious County Council would have been amply justified in saddling the ratepayers of the Metropolis with what, even in private, personally interested hands, has turned out so far a £850,000 failure." This is a strong statement to emanate from such a source; and it is to be hoped that it will have due effect in the proper quarters. The lesson of Deptford has been far too costly to be lost upon those who are wise enough to be able to learn by the experience of others.

Mr. A. H. Ward has been appointed Manager of the Bromyard Gaslight and Power Company. Mr. Ward held for twenty years the lease of the old works, which have now been replaced by others of more modern character.

Mr. G. H. Clark, who has for some time past been Assistant-Manager of the Pará Gas Company, Limited, has accepted a further engagement for twelve months with the Company. Mr. Clark was formerly a pupil of Mr. G. Lane, of Aylesbury.

THE REPORT OF THE DUTCH COMMITTEE ON PHOTOMETRY.*

As already briefly intimated in the JOURNAL, we have received, by the courtesy of Heer A. Breunissen Troost, President of the Association of Gas Managers of Holland, a copy of the final report of the Committee appointed by the Association to investigate the subject of gas-testing. The labours of the Committee have extended over a period of four years; and the mass of original research now made known shows that the time has been well employed. The report before us is amply furnished with well-executed drawings and diagrams, and is, moreover, characterized by a lucidity of expression—even in the more abstruse sections of the work—which is highly creditable to its compiler, Heer J. S. Theunissen. The Association, and especially its Committee, are to be congratulated on having produced so worthy a record of much sound and arduous work; and if, in the sequel, we at times differ from their conclusions, it is in no spirit of carping criticism. The Committee endeavour throughout to work from the first principles of physics that underlie the art of photometry; and their deductions are drawn with a conscientiousness and freedom from bias which we think are unsurpassed in the work of similar Commissions in other lands.

The introduction to the report embraces a review of the most accredited methods of gas-testing at present in vogue. Those adopted in London and Paris naturally command the most attention, and are subjected to vigorous criticism. Both have been virtually unchanged for about thirty years; and they suffer the opprobrium of having failed to advance with the times. The photometers used in London are stated to be structurally defective; and the use of wood as a material for the scales and other parts, is especially condemned. We are further plainly told that "varnish and gilding" cannot excuse faulty construction. The flame of a candle is not a point, but an extended surface, to which the law of inverse squares is not directly applicable; consequently, the disc should remain fixed at a constant distance from the standard light, in order that the illumination of it from that source may be constant. The Paris procedure conforms to this requirement; but the London photometers err in this respect. The use of two candles as the practical standard is indefensible, since the source of light is thus deliberately and avoidably perverted from the ideal point. Unless the eyes of the observer are of equal receptivity (which is very seldom the case), it is necessary that the disc should be viewed alternately from either side of the photometer, and the mean of the two placings taken. The English photometers are not arranged to permit of observations from both sides. The revolution of the disc on its axis compensates only for inequality between the two sides of the disc, and leaves unaffected the personal errors of vision of the tester. The bulb of the thermometer should be immersed in the water, and be as near as possible to the drum of the meter, instead of at the outlet, where it is subject to external influences, and does not record the temperature of the gas at its place of measurement.

The "Notifications" of the Metropolitan Gas Referees, as well as the "Instructions for the Determination of the Illuminating Power" of Paris gas, are considered in detail. The English discs are condemned, because the border-line of the greased and ungreased portions does not pass through the centre of the disc or axis of the photometer. The equality of illumination should be judged from as small a portion of the border-line as possible; that portion being about the centre of the disc. The correction for temperature and pressure is wrongly applied. It is pointed out that 5 cubic feet of gas, under normal conditions, should be consumed per hour—a result which can only be attained by finding the volume of gas, under the conditions obtaining at the time of testing, which is equivalent to 5 cubic feet under normal conditions, and consuming that volume in place of the unvarying 5 cubic feet. By the present method, it is conceivable that the volume of gas corrected to normal temperature and pressure may be 4·35 or 5·425 instead of 5 cubic feet. Unless the correction is used for the purpose of making the volume consumed per hour equivalent to 5 cubic feet under normal conditions, the test rests on the invalid assumption that the illuminating power of the flame varies in direct proportion with the volume of the gas consumed. After these strictures on English methods, it is good to learn that our standard burner —the "London" Argand—is considered incontestably superior to all rivals, and is recommended for universal adoption.

The Paris method of photometry, which is based on the principle that the gas consumption of a flame of constant lighting power diminishes as the illuminating power of the gas consumed increases, is considered to be, in some respects, superior to the London method. Gases of widely divergent quality can be tested by it; and the photometer possesses advantages over the London ones. The disc, also, which is illuminated on one side only—one half by the standard, and the other half by the light under comparison—is superior, since it presents a vertical line of demarcation through its centre for observation. The absence, and indeed impossibility, of any sufficient correction of volume for variations of temperature and pressure, and the

* "Vereeniging van Gasfabrikanten in Nederland. Rapport der Photometrie-Commissie, 1893." Leiden: P. W. M. Trap; 1894.

practical difficulties of maintaining a flame of constant lighting value, are unfavourable features of the method.

The report next deals with units and standards of light. The English standard candle, which has been condemned as unreliable times out of number, is considered by the Committee to have retained its position on account of other proposed standards possessing even greater defects. The German paraffin unit candle is used with a constant flame-length of 50 millimetres (1·97 inches), and this is maintained by manipulating the wick—a proceeding which appears to have no sufficient advantages to commend it. The German paraffin candle affords results at least as unreliable as those of the English candle; and they need not, therefore, be further considered. The French standard (the Carcel lamp), which consumes colza oil, and Keates's sperm-oil lamp, once proposed for use in England, are open to the obvious objections applicable to all wick lamps, and will not serve for accurate work. The Methven screen has the immense advantage of simplicity; but tests carried out by the Committee showed it to be unreliable, at least when uncarburetted gas is burnt. Harcourt's pentane gas standard is regarded as inconvenient. The pentane lamp is simple, and, of all existing lamps, it best satisfies the conditions required of an ideal standard. The manufacture might, however, be improved; and the fuel is unsuitable. The grounds on which the Committee arrive at the latter conclusion are certainly of dubious adequacy, as we shall shortly prove. The amyl-acetate lamp of Herr von Hefner-Alteneck is simple, and in many respects suitable; but the instability of the flame is against it. The electrical and other platinum standards are deemed beyond the pale of practical utility.

None of the existing standards fully met the views of the Committee; and they thereupon set to work to devise one more in accordance with their ideas. Harcourt's pentane lamp was taken as the basis of their investigations; but another fuel was sought. Ether was tried; but it passed up the wick too sluggishly, though an ether lamp was employed as a standard during subsequent researches. An admixture of benzene with the ether promised well; and, after many trials, the most suitable proportion of the two fluids was found. The lamp consuming the mixture of ether and benzene was tested against a pentane lamp; and, after extended trial, it was found that the deviation of the lighting value of the flame from its average value was not more than 0·1 per cent. for mixtures of 100 parts of ether with from 8·5 to 10·2 parts of benzene. To allow of a possible loss of benzene by evaporation 9 parts by weight of benzene to 100 parts by weight of ether formed the standard mixture finally selected. The specific gravity of such a standard solution is ·7335 at 15° C.; the specific gravity of the constituent benzene being ·8860, and that of the ether ·7215. The benzene and ether were obtained from Kahlbaum's works at Berlin; but later it appeared that far less pure materials could be employed without the lighting value of the mixture being affected. It appeared necessary to ascertain whether or not the components of the standard fluid were consumed in the proportion in which they existed in it. It might be expected the more volatile ether would be used up more readily than the benzene; but a determination of the specific gravity of the residual fluid in the reservoir, after reduction, by burning in the lamp, to one-tenth of its original volume, showed that no alteration in its composition had taken place. The Committee give a lengthy explanation of this phenomenon, which is so different from that of fractional distillation. Briefly, it may be said that the capillarity of the wick is the same for fluids of varying densities; and hence each constituent of a mixture is drawn up in liquid form to the point where its temperature of vaporization exists. The Committee refer to the analogous case of ordinary petroleum lamps; but they apparently fail to realize that their vindication of the principle involved in the even consumption of the mixture of ether and benzol is an eloquent testimony to the suitableness of Mr. Harcourt's pentane for a similar purpose, and renders ludicrous their previous arraignment of the latter fuel. Pentane was considered by them to have too wide a range in its temperature of distillation and permissible specific gravity. The specific gravity of pentane must be between ·728 and ·731—a margin of only ·003; whereas the ether-benzene mixture may show a variation of about ·013 in its specific gravity without the lighting power of the lamp, according to the Committee's showing, being affected. Pentane distils over between 27° and 50° to 55° C.; but the ether-benzene mixture certainly has wider limits. It is rather surprising that the Dutch Commission should not have credited so careful an experimentalist as Mr. Vernon Harcourt with the forethought to thoroughly test the working of his proposed fuel in a lamp before submitting it for general use; and we notice that they did not find it wanting in practice. That pentane is at present expensive, may be granted; but the supply of raw material is virtually inexhaustible and so abundant, that an increased demand would assuredly bring it on the market at as low a price as that of the ether-benzene mixture. We trust the Dutch photometrists were not tempted to find a substitute for pentane merely from a desire to introduce a novel standard.

The lamp in which the ether-benzene is burnt resembles in many respects the pentane lamp. The upper part of the lamp consists of a cylindrical metal chimney with two rectangular openings immediately facing one another. This upper portion of the lamp fits either on to the ether-benzene reservoir or on to a gas supply. The reservoir is furnished with a cylindrical wick, which is turned up so far in the central channel as is required to effect vaporization of the fluid at the desired rate. The upper part of the lamp is warmed for half an hour by being placed over the gas-jet, with the apex of the flame visible at the rectangular openings in the chimney. It is then transferred from the gas-stalk to the reservoir; and its warmth at once causes the fluid to vaporize at approximately the required rate. After ignition of the vapour, the flame is accurately regulated to the desired height by means of the wick-regulator. The lamp is free to swing on two short arms near the rectangular openings; and thus it is always vertical when in use.

A careful comparison of the new standard with the English sperm candle was then made. In order that the illumination of the disc by the standard light may be always constant, it is necessary that the distance between the light and the disc should be always the same, and also that the angles of incidence of the rays on the disc should be invariable. The English candle can therefore only be regarded as a definite unit of light when its position with regard to the disc is fixed. With the 60-inch Letheby photometer and 16-candle gas, the disc is about 400 mm. (15·7 inches) from the two candles. To give the same illumination of the disc, one candle should be about 280 mm. from it; but the Committee thought 300 mm. (11·8 inches) more suitable. The middle of the disc was 22·5 mm. above the edge of the cup at the upper end of the candle; the average flame-length of the English candle being 45 mm. (1·77 inches). The axis of the candle was assumed to pass through the point whence the light emanated; and the plane of curvature of the wick was turned by a right angle on the axis of the candle after every fourth part of the whole number of observations with each candle had been made with the wick in a certain position. Each candle, therefore, furnished an equal number of observations taken with the wick in each of four different positions symmetrically disposed to the axis of the candle. Standard English sperm candles were obtained from twelve different sources in Holland; and two series of tests were made with the candles from each source. Each candle was divided into four equal portions; and ten observations were taken with each portion. A specially designed candle-balance was used, and every precaution taken to include in the series only reliable tests. The photometer was designed so that the disc was fixed at a constant distance of 300 mm. from the axis of the candle. The results of 96 series, each of ten observations, are tabulated; and the average value for the distance of the ether-benzene lamp is found to be 364·85 mm. From this it appears that the value of the ether-benzene standard is 1·48 English candles. The mean deviation of the tests from the average was found to be ± 2·87 per cent.; the greatest being −9·82, the smallest −0·02 per cent.

These carefully-conducted observations cannot be passed over without some comment. We do not wish to imply that the lines on which the tests were made were theoretically faulty; but it is by no means certain that the Committee have really standardized their lamp against the English candle at the value which the latter commonly has in photometric investigations. However defective the arrangement may be, the use of two candles side by side would have given a better assurance that the illuminating power of the ether-benzene lamps was found in terms of the English candle, as the latter is officially employed in London and elsewhere. We could have wished that the experiments had been made since the Referees have undertaken the examination of candles, with specimens officially accredited; but the Committee's work was practically over before the advent of this innovation in the London procedure. But surely they would have been better advised to have procured the candles for the tests direct from the one or two English firms who make a speciality of their manufacture, rather than abroad at second hand. The doubt as to the value of the candle as used by the Committee affects all their subsequent experiments; and we would fain be persuaded that it is but visionary.

Two ether-benzene lamps were tested against one another, and the mean deviation from the average value was found to be ± 0·62 per cent. Other standards were then compared with the ether-benzene lamp. The amyl-acetate lamp of Herr von Hefner-Alteneck was found to have a value of 0·9213 English candle when the ordinary sighting arrangement was used, and of 0·9274 English candle when Kruss's optical flame-measurer was fitted to it. The deviations were of smaller value when the latter appliance was used; the average being ± 0·835 per cent., against ± 1·27 per cent. with the ordinary sight. The Carcel lamp was next compared, and was found to have a mean value of 9·631 English candles, with a mean deviation of ± 3·89 per cent. The values found by the Committee are—

	English Standard Candles.	Deviation.
Ether-benzene standard lamp	= 1·480 ..	± 0·62 per cent.
Carcel " " "	= 9·6310 ..	± 3·89 "
Amyl-acetate lamp (Hefner-Alteneck unit)	= 0·9213 ..	± 1·27
German unit paraffin candle	= 1·1053 ..	—

The last value was calculated from the ratio—

$$\frac{\text{German candle}}{\text{Hefner unit}} = 1{\cdot}2$$

(To be continued.)

THE EXPENDITURE OF ENERGY IN THE PRODUCTION OF LIGHT.

In two of the early numbers of our recently established German contemporary, the *Zeitschrift für Beleuchtungswesen*, Herr E. Rasch has brought together some interesting facts, culled from many sources, on the correlation of energy to lighting effect. The eye is, under ordinary conditions, sensitive to rays having from 480 billions to 764 billions of undulations per second; these extremes corresponding to dull red and deep violet light respectively. Beyond these limits, the eye does not gain any impression from vibrations in the ether. The ultra-violet rays, having more than 764 billions of undulations per second, specially incite chemical changes; while the ultra-red rays, having fewer than 480 billions of undulations per second, are productive of heating effects. But the visible portion of the spectrum is not free from rays of chemical and thermic power, though the ultra-red rays have 7·7 times the heating power of the visible rays. The violet rays convert less energy into heat than the red; the latter waste much of the energy which should go to the production of light. The ideal which should be aimed at in artificial lighting is hindering to the highest possible extent the emission of chemically-active and heat rays. The eye is not, however, equally sensitive to all shades of colour. According to Langley, the same amount of energy expended produces a minimum light-effect with crimson-red rays, and a maximum with green rays. Taking the effect with the crimson-red rays as unity, that of the green is 100,000; of the blue, 62,000; of the yellow, 28,000; of the orange, 14,000; of the violet, 1600; and of the red, 1200. From these figures, it is apparent that energy expended produces 100,000 times the lighting effect if wholly converted to the green instead of to the crimson-red rays. Or to produce an equal quantity of light, estimated by the eye, the horse power expended must be for red light 450,000 times as much as for green light. Relatively, the consumption of energy must be very low for the green, and extraordinarily high for the red rays; and hence green light must be regarded as the cheapest. It is noteworthy that fire-flies and glow-worms do not emit red, but green light. The expression "cold" commonly applied to green light is well deserved, since heat-rays are almost wholly absent.

Bearing in mind these facts, the efficiency of various methods of lighting may be considered. The percentage of lighting rays to the total radiation is for different kinds of light as follows: Candles, 0·29; petroleum, 0·31; gas (ordinary burner), 0·32; vegetable oil, 0·44; electric incandescent light, 6; arc electric light, 10; magnesium light, 13·70; Geissler's tubes, 33; and Welsbach light, 1·60. It thus appears that our ordinary gas and petroleum lights give a lower efficiency than the ancient oil-lights. We have learnt how to produce great quantities of light, but not how to deal more economically with the stores of energy at our disposal.

The magnesium light, which closely resembles sunlight in its composition, is compared with ordinary gaslight for relative brightness in different regions of the spectrum. The intensity of magnesium light in blue is about 9 times, and in bluish-green 3½ times that of the gaslight for the corresponding regions; but the latter light surpasses the magnesium in yellow, orange, and red rays. A similar comparison of the incandescent electric light with the Welsbach light is very suggestive. As shown by Herr von K. Mützel, whose experiments were recently alluded to in the JOURNAL, the electric light has a greater relative brightness in the red and orange regions of the spectrum, but there is equality of brightness in the yellow and bright blue; while the Welsbach light is superior in the greenish-yellow, green, and bluish-green. With the dark-blue and violet, the electric light again assumes the lead. The deficiency of the Welsbach light in red rays explains its "cold" appearance; but it had a rich warm tint compared with the electric arc light and sunlight.

Mr. T. Young has been appointed Manager of the Laurencekirk Gas-Works. There were upwards of a hundred applicants for the appointment.

Mr. John Witten, of the gas-works, Knowle, near Birmingham, has been appointed Manager of the Gorleston and Southtown Gas Company, in succession to the late Mr. F. Weller.

Pan-Anglican Legislation.—In an editorial article under this heading in the JOURNAL for the 4th inst., reference was made to a proposal put forth by Mr. Ilbert, in a paper read by him at the Imperial Institute, for the systematic collection of all the statutes passed by English-speaking self-governing communities to serve as a basis for the study of comparative legislation. We learn from *The Times* that the Lord Chancellor will hold a conference on the subject to-morrow at the Imperial Institute.

Official Changes in Connection with the East River Gas Company.—We learn from *Progressive Age* that Mr. Emerson M'Millin has resigned the presidency of the East River Gas Company; but it is understood that he will remain upon the directorate. He is succeeded by Mr. R. T. Wilson, a well-known New York banker. Mr. D. L. Hough, who has lately filled the position of General Manager of the Company, has tendered his resignation, on account, it is stated, of impaired health as the result of overwork. He purposes visiting Europe.

NOTES.

The Estimation of Sulphur in Pyrites.

In consequence of the inconvenience attending the presence of ferric salts in the solution from which sulphuric acid is to be precipitated by barium chloride, Mr. F. Johnson, F.C.S., the Chief Chemist at the Tharsis Mines, has for the past year or two been in the habit of reducing the ferric to ferrous salt, and at the same time destroying traces of nitric acid by boiling the acid solution with a sufficiency of sodium hypophosphite. He has lately given in the *Chemical News* the following description of the method by which a large number of sulphur estimations were performed there: One gramme of pyrites is weighed into a flask, 25 cubic centimetres of nitric acid added, allowed to stand for a quarter of an hour without external heat, 1½ grammes of potassium chlorate dropped in, and the assay warmed for a quarter of an hour, and then boiled down to dryness on a hot-plate—the flask being inclined (to avoid loss by spluttering). Next 20 c.c. of hydrochloric acid are added, and the assay again boiled to dryness. Another 20 c.c. of hydrochloric acid are added, and half boiled off; 50 c.c. of water added, and the assay filtered from insoluble matter; the filtrate and washings made up to about 200 c.c., 1½ grammes of sodium hypophosphite added, and the assay heated to boiling, when it quickly loses all yellow colour. A slight excess of barium chloride solution is then added, and the assay allowed to stand for three hours, when, if the supernatant liquor be clear, it may be filtered. The liquor is decanted on to the filter, and 1 c.c. of hydrochloric acid dropped on the precipitate in the flask, followed by 100 c.c. of boiling water. After five minutes, this also is poured on the filter, and the washing continued as usual. The filtrate and washings amount to from 400 to 500 c.c. Mr. Johnson states that duplicate assays usually agree to less than 0·2 in about 50 per cent. Blank assays, or checks of the reagents only, show that 0·01 to 0·02 gramme of barium sulphate is to be deducted on this account; and this is accordingly done. He believes this method gives results about ½ per cent. (0·25 in 50 per cent. of sulphur) higher than would be obtained by precipitating in presence of ferric chloride; while it is much more convenient, owing to less time and bulk of solution being required.

The Direct Conversion of Calorific into Electrical Energy.

Some interesting experiments in the direction of the immediate conversion of the calorific energy of coal into available electrical energy have been made by Dr. W. Borchers, of Duisburg; and they were described by the author at the recent meeting of the German Electro-Chemical Association. The first attempts in this line were devoted to the production of an electric current by the "combustion" of carbonic oxide gas; but Dr. Borchers has also succeeded in obtaining the same result from treating hydrogen, coal gas, and even coal dust. The apparatus used for this purpose in its original form consisted of a glass vessel divided into three compartments by two vertical plates of glass which nearly reached to its bottom. In the two end compartments, copper tubes were placed to serve for the introduction of the carbonic oxide and air; while the middle compartment contained a bell-shaped mass of carbon which constituted one plate of the cell. The vessel being partly filled with an ammoniacal or acid solution of cuprous chloride, to act as an electrolyte, it was found that when air was delivered into one compartment and carbonic oxide into the other, a weak electric current was obtained. The cuprous chloride was used because it is an absorbent of both oxygen and carbonic oxide, and is consequently particularly well suited to form the electrolyte in a gas battery in which these gases are used. After the first experiments, coal gas containing about 5 per cent. of carbonic oxide was used in place of pure carbonic oxide. When pieces of coke were placed in the liquid, a considerable increase of current resulted. With a cell in which the outer compartments were filled with copper turnings, in order to increase the absorption of carbonic oxide by exposing a greater surface, and by using coal gas in place of carbonic oxide, a maximum current of 0·64 ampère was obtained; and by increasing the external resistance, a maximum difference of potential of 0·56 resulted. The electromotive force to be derived by calculation from the heat developed by the combination of carbonic oxide and oxygen is 1·47 volts; so that in the above experiment 27 per cent. of the energy of combination of the fuel is converted into electrical energy. As a solution of cuprous chloride dissolves hydrocarbons, powdered coal was tried in place of carbonic oxide, when a maximum current of 0·4 ampère and a maximum pressure of 0·3 volt were obtained. With the coal dust, however, there is a rapid falling off of efficiency, which does not occur with the gases. This is a step in advance in the construction of gas batteries.

The Preparation of Ozone.

Those who are interested in the mystery of ozone have now an opportunity, which has hitherto been lacking, of supplying themselves at will with a quantity of this peculiar form of oxygen capable of being employed experimentally. New apparatus for generating ozone chemically has been devised by Lieutenant Poulson, a Danish officer, which is described as of a particularly simple and efficient character. It consists of a wide-necked glass jar, with a double cover of finely perforated porcelain. The top plate closes the mouth of the jar; while the lower one is in its neck. A glass rod passes through the centre of these

covers, and terminates at its lower end in a cup bent upwards for holding a piece of phosphorus. In the jar is placed enough of an acidulated aqeuous solution of permanganate of potash to cover the phosphorus, which is kept submerged when the apparatus is not in action. To produce ozone, all that is necessary is to raise the glass rod until the phosphorus is above the surface of the solution, when fumes of phosphorous acid are evolved. These fumes are seen to rise to a certain height, when they are deflected down upon the surface of the solution, into which they are absorbed, and converted into phosphoric acid by oxidation. At the same time, ozonized oxygen is liberated, and escapes by the perforations in the covers of the jar. The ozone is stated to be absolutely pure. The arrangement is at present being put upon the market for employment for sanitary purposes.

Mr. H. T. Coles, the Manager of the Taunton Corporation Water-Works, has had his salary raised by £50 per annum, in recognition of the faithful manner in which he discharges the duties of his office.

Death of Alderman Faram, of Stoke.—News has reached us of the death, in his 54th year, of Alderman Faram, ex-Mayor of Stoke, and Chairman of the Gas Committee of the Corporation. Deceased, it may be remembered, took a prominent part in the agitation which led to changes in connection with the management of the gas undertaking some months ago. The funeral took place on Monday last week.

Gas Buoys in the Solent.—With the approval of the Trinity House, four gas buoys (three provided by them, and one by the Southampton Harbour Board) have just been placed in the Solent, for its safe navigation at any time during the night. One of the buoys is at East Lepe, another is at West Brambles, the third at East Brambles, and the fourth at Netley Shoal. The light can be easily distinguished for about 2½ miles. The oil gas is specially prepared, on the Pintsch system, at Eastleigh carriage works of the London and South-Western Railway Company, whence it is conveyed in cylindrical gasholders by rail to Southampton, and then taken to the buoys by special steamer. The gasholder is charged up to about 10 atmospheres; and a flexible hose, coupled between the holder and the buoy, allows the former to charge the buoy up to 6 atmospheres, which is sufficient to keep the light constantly burning for ninety days. The new buoys, which will be maintained and supplied with gas by the Harbour Board, will give a perfectly safe passage from the Needles to Southampton Docks at any state of tide or weather; and they are looked upon by mariners as the greatest improvement ever effected so far as the navigation of the Solent is concerned.

Explosive Mixtures of Acetylene and Oxygen.—We learn from *Nature* that Professor Lothar Meyer has communicated to the *Berichte* a warning note concerning the dangerous nature of explosive mixtures of acetylene and oxygen. It is a well-known fact, frequently demonstrated upon chemical lecture-tables, that detonating mixtures of hydrogen and oxygen, or of marsh gas, ethylene, or carbon monoxide and oxygen, may be ignited in an open glass cylinder without danger, provided the vessel is not narrowed at the neck, which would be likely to cause undue pressure. Professor Meyer states that he has frequently performed the experiment with the above gaseous mixtures, employing a strong straight glass cylinder four centimetres wide and with very thick base, without ever having experienced an accident. Upon performing the experiment recently, however, with a mixture of acetylene and two-and-a-half to three times its volume of oxygen, igniting the gas by approaching the mouth of the cylinder to a flame, the cylinder was blown to innumerable fragments in his hand—happily, and almost miraculously, without injuring him, although unprotected by a cloth; and the report of the explosion was so loud as to deafen for a time those in the neighbourhood. It has long been known that acetylene explodes with oxygen in closed vessels with great violence—frequently destroying a eudiometer; but this remarkable destruction of an open cylinder is a new evidence of its disruptive force. In the year 1884, Professor Meyer, in conjunction with Professor Seubert, showed that the detonating mixture of acetylene and oxygen ignites at a lower pressure than all other combustible gases—a pressure equal to 32 millimetres of mercury being sufficient to enable it to explode, while hydrogen and oxygen require a pressure of at least 100 millimetres, and carbon monoxide and oxygen over 200 millimetres. This, however, is not sufficient to account for the enormous pressure developed in an open cylinder. Moreover, it cannot be due to the more rapid rate of propagation of the explosion; for M. Berthelot and Professor Dixon have independently found that the rapidity in the case of the acetylene detonating mixture is but slightly greater than in the mixtures of oxygen with ethylene or marsh gas, and much less than in the case of a mixture of hydrogen and oxygen. Professor Meyer suggests that the smaller amount of hydrogen contained in acetylene than the other hydrocarbons, resulting in the production of less water vapour and relatively more carbon dioxide, together with the fact that the theoretical temperature of the combustion, calculated from existing thermal data, is extremely high in the case of acetylene, may afford some explanation of the extraordinary energy developed during the explosion of the latter.

TECHNICAL RECORD.

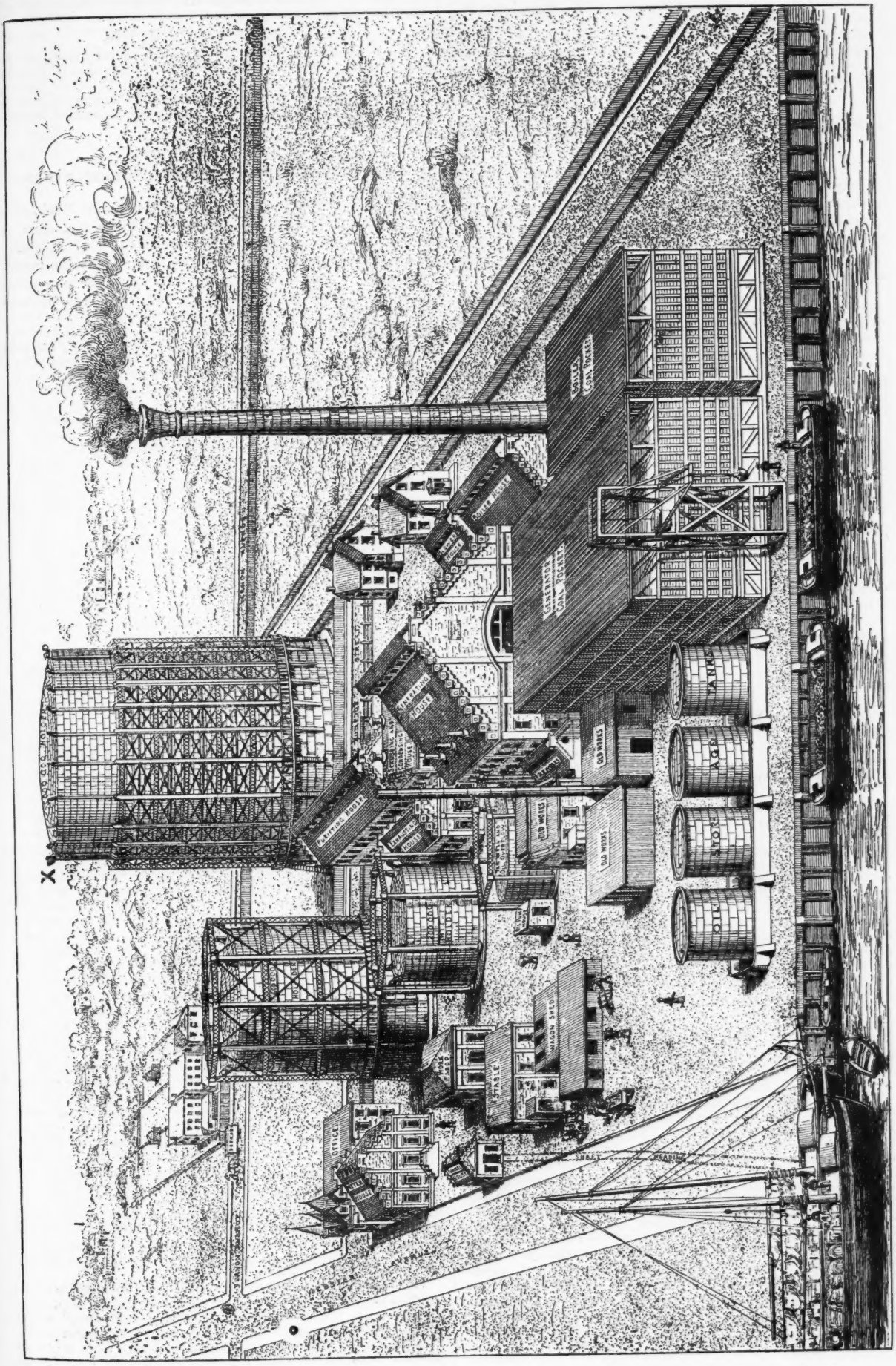
SOCIETY OF ENGINEERS.

The forty-first annual general meeting of the Society of Engineers was held on the 10th inst., at the Rooms of the Society, 17, Victoria Street, Westminster, S.W. The chair was occupied by Mr. George A. Goodwin, President. The following gentlemen were duly elected by ballot, as the Council and Officers for 1895—viz., as President, Mr. W. G. Peirce; as Vice-Presidents, Mr. C. C. Carpenter, Mr. S. H. Cox, and Mr. G. M. Lawford; as Ordinary Members of Council, Messrs. W. W. Beaumont, J. Bernays, R. W. P. Birch, W. Bradford, J. C. Fell, C. Gandon, H. O'Connor, and S. Sellon; as Honorary Secretary and Treasurer, Mr. Perry F. Nursey; as Honorary Auditors, Messrs. Alfred Lass, F.C.A., and Samuel Wood, F.C.A. The proceedings were terminated by a vote of thanks to the President, Council, and officers for 1894, which was duly acknowledged by the President.

The forty-first annual dinner of the Society was given at the Holborn Restaurant last Wednesday, when the President, who occupied the chair, was supported by Sir Robert Rawlinson, K.C.B., President of the Institution of Civil Engineers, and Mr. Alexander Siemens, the President of the Institution of Electrical Engineers. The vice-chairs were occupied by Mr. W. G. Peirce (the President-elect), Mr. William Sugg, Mr. W. A. M'Intosh Valon, J.P., Mr. Perry F. Nursey (Honorary Secretary and Treasurer), and Mr. G. A. Pryce-Cuxson (Secretary). The President, in responding to the toast of "Success to the Society of Engineers," alluded to the business transacted during the session 1893-4, and announced the award of premiums for communications made to the Society. The first premium—in future this is to be a medal of the Society—was awarded to Mr. T. W. Baker, for his paper on the "Utilization of Town Refuse for Generating Steam;" the second (the Bessemer Premium) to Mr. E. C. De Segundo, for his paper on "Power Distribution by Electricity, Water, and Gas;" and the third (the Rawlinson Prize), to Mr. R. Nelson Boyd, for his paper on "Collieries and Colliery Engineering." Mr. Goodwin also alluded to some of the vacation visits made by the Society to works of interest; among others to the Enfield Small Arms Factory, to Messrs. Siemens Bros. Electrical Works at Woolwich, and to the South Metropolitan Gas-Works in the Old Kent Road. He made fitting reference to the loss the Society had sustained during the last year by the death of Mr. Alfred Williams, who, he said, founded the Society in 1854; and by his unremitting interest and almost constant attendance at the Council meetings, had conferred a lasting benefit on the Society.

THE LARGE HOLDER OF THE EAST RIVER GAS COMPANY.

In a letter signed "Inquirer" in our "Correspondence" columns to-day, reference will be found to the large holder of the East River Gas Company, which, according to a paragraph there quoted from the *New York Herald*, was seriously damaged during a tremendous storm of wind and rain which swept over the eastern coast of New York on the 10th of October last. The accident was briefly alluded to at the time by the *American Gaslight Journal*, who, while acknowledging that the loss was considerable, did not give very definite particulars as to the nature of the damage. According to that authority, the holder was in an unusually exposed position on the western shore of Long Island; and it was in such a stage of construction as to make the guide-framing peculiarly susceptible to the action of a violent intermittent gale. If the reports since to hand are correct, this combination of circumstances brought about the wreck of the holder. The builders, however (Messrs. R. D. Wood and Co.), promptly started the work of repair. As mentioned in the note to the letter above referred to, an account of the Company's works, abridged from an illustrated description in *Progressive Age*, has already been given in the JOURNAL. But to-day we reproduce some particulars in regard to the wrecked holder, which is marked with a X on the accompanying general view of the works prepared from our contemporary. The holder is a four-lift one, working in a metal tank 190 feet in diameter and 40 ft. 6 in. deep, with guide-framing extending to the top of the second lift only. The dimensions of the lifts are as follows: Inner lift, 179 ft. 4 in. diameter and 48 ft. 6 in. deep; second lift, 182 feet diameter and 49 feet deep; third lift, 184 ft. 6 in. diameter and 48 ft. 6 in. deep; outer lift 187 feet diameter and 49 ft. 2 in. deep. The holder is to afford storeage for about 5 million cubic feet of gas; its capacity being about one-fourth greater than that of any holder in America. The difference in the depths of the lifts is due to the grip of the second lift having been raised above the level of the inner lift, and the curb of the outer lift dropped below the cups of the other lifts. The tank is one of the largest metal tanks in the world. It is of steel; and for the shell the plates are $1\frac{3}{32}$ inches thick. Being $53\frac{1}{2}$ inches wide by 25 ft. $10\frac{3}{8}$ in. long, they, at the time the holder was started, were the heaviest plates rolled in America. The shell metal is none of it below 32,000 elastic limit; and, by design, upwards of 90 per cent. of the gross section is made available in the joints. The thickness of each course is proportionately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GAS HOLDER
GAS HOLDER

reduced as the courses approach the top, where it is 7-16ths of an inch. Like the smaller holder shown on the illustration, this one is of steel, as is also the guide-framing; the only castings being the guide-rollers. The untrussed crown is supported when landed by a yellow-pine framework in the tank. The cups are fitted with Matton's patent internal overflow device, which was mentioned in the JOURNAL for March 6 last (p. 431).

THE INCOMPLETE COMBUSTION OF SOME GASEOUS CARBON COMPOUNDS.

The above subject was recently brought before the Chemical Society in a paper prepared jointly by Messrs. W. A. Bone and J. C. Cain. It had previously, as our readers are aware, been considered by the first-named gentleman in conjunction with Mr. Lean; and their work has been noticed in our columns. The following particulars in regard to the later investigations are taken from the Society's abstract of their proceedings.

The authors have extended the work of Messrs. Lean and Bone on the explosion of ethylene with less than its own volume of oxygen* to mixtures of (1) acetylene, (2) cyanogen and hydrogen, (3) normal pentane, with an amount of oxygen insufficient to oxidize all the carbon present to monoxide.

The method adopted was to explode the mixtures in a long leaden coil (except in the case of pentane, when a long glass tube could safely be employed), closed by steel taps, having at one end a glass firing-piece, and connected at the other end with a mercury pressure-gauge, so that any change in pressure on explosion could be observed. The chemical changes which would occur in such experiments would therefore be those of the "explosion wave." Both the original mixtures and the products were carefully analyzed, using a modified form of the M'Leod apparatus.

On exploding mixtures of acetylene and oxygen at atmospheric pressure, an increase in pressure of about 400 mm. of mercury was in each case noted. The products contained acetylene, a saturated hydrocarbon (doubtless methane), hydrogen, carbon monoxide, carbon dioxide, and nitrogen. Analysis shows that, when acetylene is exploded with half its volume of oxygen, the resulting interaction may be expressed by the equation—

$$2C_2H_2 + O_2 = 2CO + 2C + 2H_2.$$

On exploding a mixture of cyanogen and hydrogen with oxygen, a considerable increase in pressure occurred; and carbon was liberated. It appears that practically none of the hydrogen was oxidized during the explosion. The hydrogen and nitrogen actually found agree very well with the assumption that all the oxygen combines with cyanogen to form carbon monoxide and free nitrogen, while the excess of cyanogen breaks up into carbon and nitrogen. The carbon monoxide found is 2 per cent. lower than that given by calculation; but it must be remembered that from 1½ to 2 per cent. of carbon dioxide is formed.

The most interesting point in connection with these experiments is, however, the formation of methane and acetylene. In one case, the amounts of both these hydrocarbons were more than 1·7 per cent. The formation of methane and acetylene in these experiments must be due to the direct union of carbon and hydrogen at the high temperature of the explosion wave. Acetylene, it is well known, can be synthesized directly from its elements; but up to the present time, methane has not been so obtained. The authors, in an experiment, which, however, they wish to be regarded merely as a preliminary one, satisfied themselves that the synthesis of methane from its elements is not an impossibility. By heating pure sugar charcoal (which had previously been heated strongly in a current of chlorine, and then in a current of pure hydrogen), contained in a porcelain tube, to a white heat in a charcoal furnace, in a current of hydrogen containing a mere trace of hydrocarbon impurities, they found that 1·71 per cent. (the mean of four well-agreeing analyses) of methane was produced. This experiment will be repeated and extended.

The formation of acetylene, together with Berthelot's observation that, when acetylene was decomposed by shock (charge of fulminate), only 0·04 per cent. of it remained unchanged, incline the authors to the view that the acetylene found is due to reunion of dissociated carbon and hydrogen in or behind the explosion wave.

A mixture of 1 volume of pentane with 2¼ volumes of oxygen was exploded in a long glass tube. The mixture being just over the "explosion limit," the shock was not very violent; and the flame travelled slowly down the tube. Carbon was deposited, and an increase in pressure amounting to two atmospheres was observed. Carbon monoxide, carbon dioxide, acetylene, and hydrogen were produced. The acetylene formed may be accounted for by the fact that carbon and hydrogen were undoubtedly liberated in the explosion at a high temperature.

The experiments now described show that, when a hydrocarbon containing n atoms of carbon is burnt with n atoms of oxygen, the interaction may be represented thus—

$$C_nH_xO_n = nCO + \frac{x}{2}H_2,$$

and that a mixture of cyanogen and hydrogen may be substituted for the hydrocarbon, thus—

$$C_2N_2 + H_2O_2 = 2CO + H_2 + N_2.$$

In addition to the various other issues raised by this work the authors would draw attention to the formation of carbon dioxide in these experiments, as well as in those of Messrs. Bone and Lean on ethylene, and also to the amount of carbon dioxide formed being less, the greater the amount of oxygen (relative to the hydrocarbon) present.

* See JOURNAL, Vol. LX., p. 1127.

A SYSTEMATIZED PHOTOMETRICAL NOMENCLATURE.

M. André Blondel has contributed to *La Lumière Electrique* a suggestive article upon photometric magnitudes and units, as to which he remarks that, of all branches of physics, photometry is the one which has been least improved in the matter of its system of units. Even the electrical congresses which have been held in succession since 1881, and have endowed electrical science with units in only too great profusion, so as to actually exceed the demand, appear to have thought that photometry only needed a good standard of light—which, by the way, it still needs. This is too optimistic a view; and there is now a reaction against it. Not that photometry as a science requires recasting in a fresh mould, since it is based upon a few firmly-established physical principles, which cannot give rise to any objections. Photometric nomenclature is, however, in M. Blondel's mind, open to criticism; and the number of photometric units strike him as being insufficient. These shortcomings he proposes to supply, in a manner to be discussed later on. The first thing which M. Blondel notices in photometry is that it has retained, without much alteration, the language given to it in the last century. For example, the classic phraseology gives the name of "quantity of light" to that which is really the *flux* of light; and thus puts itself into contradiction with the terminology of the cognate science of Heat. It would never enter the head of a modern student of Heat to confound the *quantity* of heat with its *flux*, for the first is a product of the second into the *time*. Hence it appears to M. Bondel the height of unreason to preserve this source of confusion in photometry; and accordingly he proposes that henceforth use should be made of the notions of flux and of quantity of light in exactly the same way as is done in the science of Heat. He also suggests that it would be a good thing to get rid of the word "brightness" (*clarté*), which every author uses in a different sense, and to definitely allocate the word "brilliancy" (*éclat*) to the intrinsic brilliancy of the source of light.

M. Blondel protests against the misunderstanding that exists with regard to the photometrical units. Of these he makes out that there are six, or rather that there are six fundamental quantities of photometry—viz., intensity (*intensité*), flux (*flux*), lighting (*éclairement*), intrinsic brilliancy (*éclat intrinsèque*), lighting-time (*illumination*), and quantity of light (*quantité de lumière*); the last being connected with energy. Yet there is a single unit—the candle—to serve for all, which leads to such conventional expressions as the "candle-foot." The first necessity, therefore, in order to restore rationality to photometry is to establish the notion of the *flux* of light, which is, after all, a perfectly natural notion, seeing that no initiation into scientific habits of thought is needed to enable anyone to perceive that light spreads itself in all directions. The irrational thing is the convention which expresses luminous output as well as the intensity of the light-source in candles. M. Blondel refers to the familiar trick of Yankee electricians known (outside France) as "French measurement," whereby an arc lamp sending out the light of 500 candles along four cross-roads is calculated to be of an illuminating power of 2000 candles. He declares that the idea which underlies this trick is, in point of fact, a sensible one; because the quantity of most importance in lighting is really the flux of light, or the flow of light in all directions from its source; and if photometry does not contain an expression for defining a lamp with this in view, it is photometry which is at fault. Photometry is still more in the wrong when it conceals the idea of the flux of light under artificial terms, such as that of "volume of lighting" (*volume d'éclairement*)—a quantity which is obtained by calculating the lighting of every point of the ground underneath the light-source, and then integrating the product of each determination into the corresponding area. This "volume of lighting" is merely the flux of light emitted by the source over the corresponding solid angle, and therefore in nowise depends on the orientation of the ground lit up. Why, then, asks M. Blondel, instead of giving the quantity its proper name, compound this strange amalgam of photometry and geometry?

The confusion which has been permitted to arise between flux and intensity of light necessarily makes for corresponding ambiguity in the definition of "intrinsic brilliancy," which hardly two writers upon photometry use in the same sense. All this leads to the conclusion that it is high time a special unit was adopted for each separate photometric quantity, as is done with everything else. Even the photographers have shown the lead in this direction; for they have already established a unit of time-illumination for their own purposes—the

"*phot*." Accepting this lead, M. Blondel proceeds to review the different photometric quantities already mentioned, for the purpose of determining their mutual relations.

1.—The *luminous intensity* of a source of light in any given direction is the ratio of the flux emitted over a small solid angle which has this direction for its axis. The intensity is expressed in the terms of some unit of light. The unit adopted by the Congress of 1881 and the International Congress of 1884 is the "Violle;" being the light emitted by a square centimetre of the surface of molten platinum at the moment of solidification. This unit, after receiving such distinguished patronage, having proved practically useless, the Congress of 1889 had to adopt a secondary practical unit, which was the so-called "*bougie décimale*," imagined to be equal to the twentieth part of a "Violle." This result was deplorable, inasmuch as the "*bougie décimale*" has no real existence. It is not the tenth part of a Carcel, nor is it equivalent to the light of any known candle. In their desire to be universal, the Congresses which adopted these two absurd units did not even succeed in suiting the requirements of a single living photometrist; and, in consequence of this ineptitude, the photometrists of every nation have since gone their own way in search of practical light-units. M. Blondel suggests that the name *pyr*, from the Greek, should be given to whatever may be finally adopted as the unit of intensity of light. For the present, this might be taken to be the "*bougie décimale*." It is observed that there would be another advantage in the use of a new name, such as the *pyr*, for the unit of light intensity, in the fact that it would give a sort of scientific stamp to light-measurements. M. Blondel appears to think that there is something common and over-simple about the word "candle," which is derogatory to the dignity of science. It does not matter if the *pyr* is really equal to a candle or not. This author holds that it would be a distinct advantage that the uninstructed public should be overawed by being talked to about *pyrs* of lighting effect! It is worthy of note here that the only objection which English science entertains with regard to the use of the candle as the standard of light is that its value is so difficult to determine, not that the term is so easy and common.

2.—The *luminous flux* Φ should have for its practical unit the flux which takes place over a solid angle equal to unity from a source considered as a point having the luminous intensity of one *pyr*. The word "*lumen*" is suggested for this unit. A source of light having a mean spherical intensity of *n pyrs* would thus have a total flux of $4\pi n$ *lumens*.

3.—The *lighting effect* e at a point of a surface is equal to the ratio of the luminous flux which falls on a small element of surface to the area of this surface—thus $e = d\Phi/ds$. It being absolutely necessary to adopt a new name for the unit of lighting effect in substitution for the local and conventional terms "*bougie mètre*" and "candle-foot," M. Blondel appropriates the word "*lux*" proposed by Mr. W. H. Preece at the 1889 Congress, and makes it mean a "*bougie-mètre*," or rather a "*pyr-mètre*." According to the terminology previously indicated, the *lux* must be defined as "the lighting effect produced by a uniform source of light of one *pyr* intensity on a surface at right angles to the rays, and situated at a distance of one metre," or, which comes to the same thing, "the lighting effect produced on a surface of one square metre by a uniform *flux* of the *lumen*." Inversely, the *lumen* could be defined as "the luminous flux capable of illuminating a square metre of surface to the extent of the *lux*." The product of a certain number of *lux* into a surface measured in square metres will thus give a number of *lumens* representing the total flux received by this surface.

4.—The *intrinsic brilliancy* i should have the usual meaning of the quotient of the intensity, measured at right angles, by the area of surface of the emitting source $i = I/S$. The practical unit of brilliancy is the intrinsic brilliancy of a source of light giving one *pyr* per unit of surface, being 1-20th of the brilliancy of the Violle standard. (This assumes that the area of surface of the standard is one square centimetre.) To be logically complete, we should also define the unit of *intrinsic radiation* of one *lumen* per unit of surface. In general, there is no simple relation between the intrinsic brilliancy and the intrinsic radiation; but when the source follows Lambert's law, a brilliancy of *n pyrs* per square centimetre corresponds to an intrinsic radiation of πn *lumens* per square centimetre.

5.—Time illumination is, by definition, the product of the lighting effect e to which an object is submitted, into the duration of such lighting effect. The unit is the *lux-second*, which signifies the lighting effect obtained by an object from an illumination of one *lux* continued for a second. This unit is actually in evidence; having been adopted by the Brussels Photographic Congress under the specific name of "*phot*." It plays an important part in photography, since the chemical reactions appear to depend directly on the product $e\,t$. The same law holds good of certain physiological phenomena connected with vision and visual acuity, since a certain minimum duration of the lighting effect is necessary to create the impression of light. It is assumed in a general way that there must be about 10^{-8} *phot* in the plane of the pupil to enable it to perceive a punctiform source of light.

6.— The *quantity of light* should no longer be confounded with the *flux of light*, as already observed. The quantity of light L is, by definition, the product of the flux of light into its *duration*. It is therefore to be measured by the unit of the *lumen-second*, for which quantity the term "*rad*" has already been proposed by certain photographers. The *rad* may also be defined as the quantity of light received by a unit surface (one square metre) exposed to an illumination of one *phot*. We can thus express in *rads* the quantity of light necessary to produce a luminous impression on the retina. For commercial purposes, it might be enough to measure the quantity of light in *lumen-hours* in the same way as the quantity of electricity is measured in ampère-hours instead of in coulombs. This quantity, the *lumen-hour*, could be made the basis of lighting contracts. Since the quantity of light for a radiation of given wave-lengths is proportional to the energy of the radiations, it might be possible to denote it in ergs, as with other forms of energy; but with polychrome sources of light, this datum has no simple relation with the photometric effect produced, since every radiation has a different coefficient of physiological action.

It now comes to be a question of how the units above defined could be used in practice. M. Blondel begins by applying his suggestions to the measurement and expression of the luminous effect of an electric arc lamp, as to which he confesses that much uncertainty prevails. So notoriously is this the case, that, as he says, European electricians have mostly given up designating arc lamps otherwise than by their electrical constants. M. Blondel rightly scouts the American trick of calling an arc lamp a lamp of 2000-candle power, irrespective of its true illuminating value. The alternative, however, is open to the objection of leaving too much to the quality of the carbons; and, after all, what the user wants is light. It is suggested that all uncertainty in this regard would disappear if electricians would agree to designate lamps by their total flux expressed in *lumens*, which is equivalent to their mean spherical intensity multiplied by 4π. A lamp of 30 spherical Carcel power would thus become a lamp of 3770 *lumens*. Artfully enough, the author suggests that the new system would give to lamp makers the satisfaction of expressing the performance of their lamps in bigger figures than are available by the present system, while the public would not be confused. This rating might be supplemented by stating how many *lumens* are emitted above and below the horizontal, seeing that the latter are alone of any value for street lighting. M. Blondel argues that when a town buys light from a company for the streets, this might be paid for according to the number of *lumen-hours* supplied during the year below the horizontal plane of the lamps; and he does not think that it would be impossible to draw up lighting contracts in this form.

With regard to the lighting of interiors, such as (say) a ball-room, M. Blondel remarks that the eye judges of the illumination of a room by the average lighting effect e produced on the walls. This should be inversely proportioned to the diffusive power of the wall surfaces. We thus have, taking k as a constant, $e\,d = k$. If we call a the absorbing power, and S the superficies of the walls, we find (neglecting the effect of the furniture, &c.) that the total luminous flux which it is necessary for the lamps to produce should equal the flux absorbed, thus—

$$\Phi = a\,e\,S = S\,k\,\frac{a}{d} = S\,k\,\frac{a}{1-a}.$$

That is to say, it should be proportioned to the *total* superficial area of the exposed surfaces, and a certain number of *lumens* are required to the square metre. It might be possible to state the lighting effect in *pyrs* per square metre. But M. Blondel objects that this is a fundamentally vicious way of expressing it; and therefore it is better left in the form first given. For example, if $k = 5$ *pyrs*, and the coefficient of absorption of the walls $a = 0{\cdot}60$, then 7·5 *lumens* will have to be produced per square metre of floor, roof, and walls.

The most instructive of all the applications to which M. Blondel's suggested system of units is made by the author is, however, that of calculating and expressing the effect of a projector upon a source of light. Here the rationality of the idea of taking the flux of light as the starting-point is most apparent, because the effect of applying a projector to a source of light is to reinforce the light radiated in a particular direction by a concentrated beam composed of all the radiations sent out in the opposite direction. M. Blondel's system offers a way of escape from the exaggerations and misunderstandings inherent in the ordinary methods of determining and stating the illuminating power of concentrated beams. In conclusion, M. Blondel sums up his proposed system of units in the following table:—

Physical Quantities.	Symbols and Defining Equations.	Dimensions.	Names of the Practical Units.
Luminous intensity	I	$[I]$	*Pyr*, or "*bougie-décimale*," 1-20th of a *Violle*.
Luminous flux . .	$\Phi = I\,\sigma^*$	$[I]$	*Lumen*.
Illumination . . .	$e = \frac{\Phi}{S}$	$[IL^{-2}]$	*Lux*.
Intrinsic brilliancy .	$i = \frac{I}{S}$	$[IL^{-2}]$	*Pyr* per square centimetre.
Intrinsic radiation .	$\phi = \frac{\Phi}{S}$	$[IL^{-2}]$	*Lumen* per sq. centimetre.
Time-illumination .	$j = et$	$[IL^{-2}T]$	*Phot*, or *lux-second*.
Quantity of light .	$Q = \Phi\,t$	$[IT]$	*Rad*, or *lumen-second*.

* σ solid angle; dimension; a number.

reduced as the courses approach the top, where it is 7·16ths of an inch. Like the smaller holder shown on the illustration, this one is of steel, as is also the guide-framing; the only castings being the guide-rollers. The untrussed crown is supported when landed by a yellow-pine framework in the tank. The cups are fitted with Matton's patent internal overflow device, which was mentioned in the JOURNAL for March 6 last (p. 431).

THE INCOMPLETE COMBUSTION OF SOME GASEOUS CARBON COMPOUNDS.

The above subject was recently brought before the Chemical Society in a paper prepared jointly by Messrs. W. A. Bone and J. C. Cain. It had previously, as our readers are aware, been considered by the first-named gentleman in conjunction with Mr. Lean; and their work has been noticed in our columns. The following particulars in regard to the later investigations are taken from the Society's abstract of their proceedings.

The authors have extended the work of Messrs. Lean and Bone on the explosion of ethylene with less than its own volume of oxygen* to mixtures of (1) acetylene, (2) cyanogen and hydrogen, (3) normal pentane, with an amount of oxygen insufficient to oxidize all the carbon present to monoxide.

The method adopted was to explode the mixtures in a long leaden coil (except in the case of pentane, when a long glass tube could safely be employed), closed by steel taps, having at one end a glass firing-piece, and connected at the other end with a mercury pressure-gauge, so that any change in pressure on explosion could be observed. The chemical changes which would occur in such experiments would therefore be those of the "explosion wave." Both the original mixtures and the products were carefully analyzed, using a modified form of the M'Leod apparatus.

On exploding mixtures of acetylene and oxygen at atmospheric pressure, an increase in pressure of about 400 mm. of mercury was in each case noted. The products contained acetylene, a saturated hydrocarbon (doubtless methane), hydrogen, carbon monoxide, carbon dioxide, and nitrogen. Analysis shows that, when acetylene is exploded with half its volume of oxygen, the resulting interaction may be expressed by the equation—

$$2C_2H_2 + O_2 = 2CO + 2C + 2H_2.$$

On exploding a mixture of cyanogen and hydrogen with oxygen, a considerable increase in pressure occurred; and carbon was liberated. It appears that practically none of the hydrogen was oxidized during the explosion. The hydrogen and nitrogen actually found agree very well with the assumption that all the oxygen combines with cyanogen to form carbon monoxide and free nitrogen, while the excess of cyanogen breaks up into carbon and nitrogen. The carbon monoxide found is 2 per cent. lower than that given by calculation; but it must be remembered that from 1½ to 2 per cent. of carbon dioxide is formed.

The most interesting point in connection with these experiments is, however, the formation of methane and acetylene. In one case, the amounts of both these hydrocarbons were more than 1·7 per cent. The formation of methane and acetylene in these experiments must be due to the direct union of carbon and hydrogen at the high temperature of the explosion wave. Acetylene, it is well known, can be synthesized directly from its elements; but up to the present time, methane has not been so obtained. The authors, in an experiment, which, however, they wish to be regarded merely as a preliminary one, satisfied themselves that the synthesis of methane from its elements is not an impossibility. By heating pure sugar charcoal (which had previously been heated strongly in a current of chlorine, and then in a current of pure hydrogen), contained in a porcelain tube, to a white heat in a charcoal furnace, in a current of hydrogen containing a mere trace of hydrocarbon impurities, they found that 1·71 per cent. (the mean of four well-agreeing analyses) of methane was produced. This experiment will be repeated and extended.

The formation of acetylene, together with Berthelot's observation that, when acetylene was decomposed by shock (charge of fulminate), only 0·04 per cent. of it remained unchanged, incline the authors to the view that the acetylene found is due to reunion of dissociated carbon and hydrogen in or behind the explosion wave.

A mixture of 1 volume of pentane with 2½ volumes of oxygen was exploded in a long glass tube. The mixture being just over the "explosion limit," the shock was not very violent; and the flame travelled slowly down the tube. Carbon was deposited, and an increase in pressure amounting to two atmospheres was observed. Carbon monoxide, carbon dioxide, acetylene, and hydrogen were produced. The acetylene formed may be accounted for by the fact that carbon and hydrogen were undoubtedly liberated in the explosion at a high temperature.

The experiments now described show that, when a hydrocarbon containing n atoms of carbon is burnt with n atoms of oxygen, the interaction may be represented thus—

$$C_nH_xO_n = nCO + \frac{x}{2}H_2,$$

and that a mixture of cyanogen and hydrogen may be substituted for the hydrocarbon, thus—

$$C_2N_2 + H_2O_2 = 2CO + H_2 + N_2.$$

In addition to the various other issues raised by this work the authors would draw attention to the formation of carbon dioxide in these experiments, as well as in those of Messrs. Bone and Lean on ethylene, and also to the amount of carbon dioxide formed being less, the greater the amount of oxygen (relative to the hydrocarbon) present.

* See JOURNAL, Vol. LX., p. 1127.

A SYSTEMATIZED PHOTOMETRICAL NOMENCLATURE.

M. André Blondel has contributed to *La Lumière Electrique* a suggestive article upon photometric magnitudes and units, as to which he remarks that, of all branches of physics, photometry is the one which has been least improved in the matter of its system of units. Even the electrical congresses which have been held in succession since 1881, and have endowed electrical science with units in only too great profusion, so as to actually exceed the demand, appear to have thought that photometry only needed a good standard of light—which, by the way, it still needs. This is too optimistic a view; and there is now a reaction against it. Not that photometry as a science requires recasting in a fresh mould, since it is based upon a few firmly-established physical principles, which cannot give rise to any objections. Photometric nomenclature is, however, in M. Blondel's mind, open to criticism; and the number of photometric units strike him as being insufficient. These shortcomings he proposes to supply, in a manner to be discussed later on. The first thing which M. Blondel notices in photometry is that it has retained, without much alteration, the language given to it in the last century. For example, the classic phraseology gives the name of "quantity of light" to that which is really the *flux* of light; and thus puts itself into contradiction with the terminology of the cognate science of Heat. It would never enter the head of a modern student of Heat to confound the *quantity* of heat with its *flux*, for the first is a product of the second into the *time*. Hence it appears to M. Bondel the height of unreason to preserve this source of confusion in photometry; and accordingly he proposes that henceforth use should be made of the notions of flux and of quantity of light in exactly the same way as is done in the science of Heat. He also suggests that it would be a good thing to get rid of the word "brightness" (*clarté*), which every author uses in a different sense, and to definitely allocate the word "brilliancy" (*éclat*) to the intrinsic brilliancy of the source of light.

M. Blondel protests against the misunderstanding that exists with regard to the photometrical units. Of these he makes out that there are six, or rather that there are six fundamental quantities of photometry—viz., intensity (*intensité*), flux (*flux*), lighting (*éclairement*), intrinsic brilliancy (*éclat intrinsèque*), lighting-time (*illumination*), and quantity of light (*quantité de lumière*); the last being connected with energy. Yet there is a single unit—the candle—to serve for all, which leads to such conventional expressions as the "candle-foot." The first necessity, therefore, in order to restore rationality to photometry is to establish the notion of the *flux* of light, which is, after all, a perfectly natural notion, seeing that no initiation into scientific habits of thought is needed to enable anyone to perceive that light spreads itself in all directions. The irrational thing is the convention which expresses luminous output as well as the intensity of the light-source in candles. M. Blondel refers to the familiar trick of Yankee electricians known (outside France) as "French measurement," whereby an arc lamp sending out the light of 500 candles along four cross-roads is calculated to be of an illuminating power of 2000 candles. He declares that the idea which underlies this trick is, in point of fact, a sensible one; because the quantity of most importance in lighting is really the flux of light, or the flow of light in all directions from its source; and if photometry does not contain an expression for defining a lamp with this in view, it is photometry which is at fault. Photometry is still more in the wrong when it conceals the idea of the flux of light under artificial terms, such as that of "volume of lighting" (*volume d'éclairement*)—a quantity which is obtained by calculating the lighting of every point of the ground underneath the light-source, and then integrating the product of each determination into the corresponding area. This "volume of lighting" is merely the flux of light emitted by the source over the corresponding solid angle, and therefore in nowise depends on the orientation of the ground lit up. Why, then, asks M. Blondel, instead of giving the quantity its proper name, compound this strange amalgam of photometry and geometry?

The confusion which has been permitted to arise between flux and intensity of light necessarily makes for corresponding ambiguity in the definition of "intrinsic brilliancy," which hardly two writers upon photometry use in the same sense. All this leads to the conclusion that it is high time a special unit was adopted for each separate photometric quantity, as is done with everything else. Even the photographers have shown the lead in this direction; for they have already established a unit of time-illumination for their own purposes—the

"*phot*." Accepting this lead, M. Blondel proceeds to review the different photometric quantities already mentioned, for the purpose of determining their mutual relations.

1.—The *luminous intensity* of a source of light in any given direction is the ratio of the flux emitted over a small solid angle which has this direction for its axis. The intensity is expressed in the terms of some unit of light. The unit adopted by the Congress of 1881 and the International Congress of 1884 is the "Violle;" being the light emitted by a square centimetre of the surface of molten platinum at the moment of solidification. This unit, after receiving such distinguished patronage, having proved practically useless, the Congress of 1889 had to adopt a secondary practical unit, which was the so-called "*bougie décimale*," imagined to be equal to the twentieth part of a "Violle." This result was deplorable, inasmuch as the "*bougie décimale*" has no real existence. It is not the tenth part of a Carcel, nor is it equivalent to the light of any known candle. In their desire to be universal, the Congresses which adopted these two absurd units did not even succeed in suiting the requirements of a single living photometrist; and, in consequence of this ineptitude, the photometrists of every nation have since gone their own way in search of practical light-units. M. Blondel suggests that the name *pyr*, from the Greek, should be given to whatever may be finally adopted as the unit of intensity of light. For the present, this might be taken to be the "*bougie décimale*." It is observed that there would be another advantage in the use of a new name, such as the *pyr*, for the unit of light intensity, in the fact that it would give a sort of scientific stamp to light-measurements. M. Blondel appears to think that there is something common and over-simple about the word "candle," which is derogatory to the dignity of science. It does not matter if the *pyr* is really equal to a candle or not. This author holds that it would be a distinct advantage that the uninstructed public should be overawed by being talked to about *pyrs* of lighting effect! It is worthy of note here that the only objection which English science entertains with regard to the use of the candle as the standard of light is that its value is so difficult to determine, not that the term is so easy and common.

2.—The *luminous flux* Φ should have for its practical unit the flux which takes place over a solid angle equal to unity from a source considered as a point having the luminous intensity of one *pyr*. The word "*lumen*" is suggested for this unit. A source of light having a mean spherical intensity of *n pyrs* would thus have a total flux of $4\pi n$ *lumens*.

3.—The *lighting effect* e at a point of a surface is equal to the ratio of the luminous flux which falls on a small element of surface to the area of this surface—thus $e = d\Phi/ds$. It being absolutely necessary to adopt a new name for the unit of lighting effect in substitution for the local and conventional terms "*bougie mètre*" and "candle-foot," M. Blondel appropriates the word "*lux*" proposed by Mr. W. H. Preece at the 1889 Congress, and makes it mean a "*bougie-mètre*," or rather a "*pyr-mètre*." According to the terminology previously indicated, the *lux* must be defined as "the lighting effect produced by a uniform source of light of one *pyr* intensity on a surface at right angles to the rays, and situated at a distance of one metre," or, which comes to the same thing, "the lighting effect produced on a surface of one square metre by a uniform *flux* of the *lumen*." Inversely, the *lumen* could be defined as "the luminous flux capable of illuminating a square metre of surface to the extent of the *lux*." The product of a certain number of *lux* into a surface measured in square metres will thus give a number of *lumens* representing the total flux received by this surface.

4.—The *intrinsic brilliancy* i should have the usual meaning of the quotient of the intensity, measured at right angles, by the area of surface of the emitting source $i = I/S$. The practical unit of brilliancy is the intrinsic brilliancy of a source of light giving one *pyr* per unit of surface, being 1-20th of the brilliancy of the Violle standard. (This assumes that the area of surface of the standard is one square centimetre.) To be logically complete, we should also define the unit of *intrinsic radiation* of one *lumen* per unit of surface. In general, there is no simple relation between the intrinsic brilliancy and the intrinsic radiation; but when the source follows Lambert's law, a brilliancy of *n pyrs* per square centimetre corresponds to an intrinsic radiation of πn *lumens* per square centimetre.

5.—Time illumination is, by definition, the product of the lighting effect e to which an object is submitted, into the duration of such lighting effect. The unit is the *lux-second*, which signifies the lighting effect obtained by an object from an illumination of one *lux* continued for a second. This unit is actually in evidence; having been adopted by the Brussels Photographic Congress under the specific name of "*phot*." It plays an important part in photography, since the chemical reactions appear to depend directly on the product $e\,t$. The same law holds good of certain physiological phenomena connected with vision and visual acuity, since a certain minimum duration of the lighting effect is necessary to create the impression of light. It is assumed in a general way that there must be about 10^{-8} *phot* in the plane of the pupil to enable it to perceive a punctiform source of light.

6.— The *quantity of light* should no longer be confounded with the *flux of light*, as already observed. The quantity of light L is, by definition, the product of the flux of light into its *duration*. It is therefore to be measured by the unit of the *lumen-second*, for which quantity the term "*rad*" has already been proposed by certain photographers. The *rad* may also be defined as the quantity of light received by a unit surface (one square metre) exposed to an illumination of one *phot*. We can thus express in *rads* the quantity of light necessary to produce a luminous impression on the retina. For commercial purposes, it might be enough to measure the quantity of light in *lumen-hours* in the same way as the quantity of electricity is measured in ampère-hours instead of in coulombs. This quantity, the *lumen-hour*, could be made the basis of lighting contracts. Since the quantity of light for a radiation of given wave-lengths is proportional to the energy of the radiations, it might be possible to denote it in ergs, as with other forms of energy; but with polychrome sources of light, this datum has no simple relation with the photometric effect produced, since every radiation has a different coefficient of physiological action.

It now comes to be a question of how the units above defined could be used in practice. M. Blondel begins by applying his suggestions to the measurement and expression of the luminous effect of an electric arc lamp, as to which he confesses that much uncertainty prevails. So notoriously is this the case, that, as he says, European electricians have mostly given up designating arc lamps otherwise than by their electrical constants. M. Blondel rightly scouts the American trick of calling an arc lamp a lamp of 2000-candle power, irrespective of its true illuminating value. The alternative, however, is open to the objection of leaving too much to the quality of the carbons; and, after all, what the user wants is light. It is suggested that all uncertainty in this regard would disappear if electricians would agree to designate lamps by their total flux expressed in *lumens*, which is equivalent to their mean spherical intensity multiplied by 4π. A lamp of 30 spherical Carcel power would thus become a lamp of 3770 *lumens*. Artfully enough, the author suggests that the new system would give to lamp makers the satisfaction of expressing the performance of their lamps in bigger figures than are available by the present system, while the public would not be confused. This rating might be supplemented by stating how many *lumens* are emitted above and below the horizontal, seeing that the latter are alone of any value for street lighting. M. Blondel argues that when a town buys light from a company for the streets, this might be paid for according to the number of *lumen-hours* supplied during the year below the horizontal plane of the lamps; and he does not think that it would be impossible to draw up lighting contracts in this form.

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$$\Phi = a\,e\,S = S\,k\,\frac{a}{d} = S\,k\,\frac{a}{1-a}.$$

That is to say, it should be proportioned to the *total* superficial area of the exposed surfaces, and a certain number of *lumens* are required to the square metre. It might be possible to state the lighting effect in *pyrs* per square metre. But M. Blondel objects that this is a fundamentally vicious way of expressing it; and therefore it is better left in the form first given. For example, if $k = 5$ *pyrs*, and the coefficient of absorption of the walls $a = 0{\cdot}60$, then 7·5 *lumens* will have to be produced per square metre of floor, roof, and walls.

The most instructive of all the applications to which M. Blondel's suggested system of units is made by the author is, however, that of calculating and expressing the effect of a projector upon a source of light. Here the rationality of the idea of taking the flux of light as the starting-point is most apparent, because the effect of applying a projector to a source of light is to reinforce the light radiated in a particular direction by a concentrated beam composed of all the radiations sent out in the opposite direction. M. Blondel's system offers a way of escape from the exaggerations and misunderstandings inherent in the ordinary methods of determining and stating the illuminating power of concentrated beams. In conclusion, M. Blondel sums up his proposed system of units in the following table:—

Physical Quantities.	Symbols and Defining Equations.	Dimensions.	Names of the Practical Units.
Luminous intensity	I	$[I]$	*Pyr*, or "*bougie-décimale*," 1-20th of a *Violle*.
Luminous flux . .	$\Phi = I\,\sigma^*$	$[I]$	*Lumen*.
Illumination . . .	$e = \frac{\Phi}{S}$	$[IL^{-2}]$	*Lux*.
Intrinsic brilliancy .	$i = \frac{I}{S}$	$[IL^{-2}]$	*Pyr* per square centimetre.
Intrinsic radiation .	$\phi = \frac{\Phi}{S}$	$[IL^{-2}]$	*Lumen* per sq. centimetre.
Time-illumination .	$j = et$	$[IL^{-2}T]$	*Phot*, or *lux-second*.
Quantity of light .	$Q = \Phi\,t$	$[IT]$	*Rad*, or *lumen-second*.

* σ solid angle; dimension; a number.

In taking intensity as the fundamental magnitude in constructing this system, the author follows present usages, without, however, connecting it with other physical units, because it is a physiological rather than a physical quantity. He thinks that this system of units, being in conformity with those applying to electricity and magnetism, could be adopted, as those have been; and he professes to be unable to understand why that kind of systematizing which is generally recognized as being useful and even necessary in every other branch of physics should be deemed superfluous in photometry.

We are indebted to the *Electrician* for the full literal translation of M. Blondel's article from which the foregoing abstract has been made. In giving currency to his views, it is desirable to accompany them with a few points of the criticism offered on the subject by our contemporary in an introductory article. It is admitted that the "flux of light," upon which M. Blondel bases his suggested system, exists; but it has unfortunately not been recognized in the nomenclature of photometry. It is one thing, however, to admit this physical truth, which must be obvious as soon as attention is drawn to it, and quite another to introduce a term for it into the current language of photometry, with its positive commercial bearings. Upon this head, our contemporary remarks as follows:—

It seems highly probable that in this country and in America the "candle power" will remain, while its magnitude may perhaps be adjusted by a congress or by the Board of Trade. The unit of luminous flux may, perhaps, deserve a name; but it cannot be a "candle." The idea that a light of 1-candle power gives the light of 4π, or 12·57 "candles," though technically true, would be too absurd. This flux is often spoken of as "total light," or "quantity of light." This is not quite accurate. We really mean, as it were, a current of light or rate of emission of luminous radiant energy. The product of this by unit time would give a true quantity. M. Blondel's last unit is of this kind; but it is not likely to be often required. It is, under certain circumstances, necessary to employ the notion of a flux of light; and it is wrong to describe the unit as 4π-candle power. Hence the need for a name. If some name is not adopted, enterprising lamp makers will advertise lamps of 201 candles, meaning 16-candle power. The third unit, that of illumination, really needs a name. M. Hospitalier and others have strongly objected to the "*bougie-metre*" and to the "candle-foot;" and, with some sophistry, it has been argued in defence that, although there may be a little ambiguity in speaking of "7·5 candle-feet," there is nothing unsound in "7·5 times a candle-foot." It is a question whether M. Blondel's "illumination," "intrinsic brilliancy," and "intrinsic radiation" might not be reduced to a single unit. It will be seen that their dimensions are identical. There is a very simple connection between them; and a little examination will show that the same unit will do for each. Suppose a light of k candle power has an effective luminous area of a square feet. If the light be an opaque incandescent sphere of one foot radius, it will show in any given direction a projected area of π square feet, or the same as a disc of one foot radius. Its brightness or intrinsic brilliancy is its candle power per unit area, or k/π candle power per square foot. The total quantity of light, or luminous flux, emitted by the sphere is $4\pi\ k$ units; and the illumination it can produce at a distance of f feet (this distance being not less than 8 or 10 feet) is k/f^2 candle-feet. If it be desired, then, to know the quantity of light given out per unit area of a luminous body, this is at once obtained from the brightness by multiplying by π. Now, the total flux of light emitted by the sphere is $4\pi \times k$ units, and the total area of luminous surface is $4\pi \times 1^2$ square feet; hence the intrinsic radiation, which might, with some reason, be called the illumination of the luminous surface is $(4\pi \times k) / (4\pi \times 1^2) = 1$ candle-foot, where $k = 1$. This, as we have already shown, is π times the brightness—a relation which always holds good. The surface of such a self-luminous sphere emitting pure white light cannot be distinguished from a non-self-luminous sphere dead white, reflecting or scattering cent. per cent. of the light falling on it, and illuminated from some external source with the illumination of one candle-foot. As a corollary of some interest in connection with dead white reflectors, it may be remarked that a perfect white reflector of one square foot illuminated with π candle-feet emits 1-candle power normally."

We agree with the above generally. It is impossible to form an accurate notion of the phenomena of lighting, including such effects as projection, reflection, and diffusion, all of which are of great practical moment, without keeping in mind the fundamental idea of light as a flux. Practical photometry has only taken account of the illuminating power *in one direction* of a light-source. In order to make this measurement with a reasonable degree of accuracy, it has been the practice to compare the light of the source to be measured against that of a standard of light, setting the one over against the other, and screening off all but those rays which directly follow the line passing through the two lights and the screen placed between them for the purpose of determining the point of equal lighting effect. Moreover, it has been necessary to suppress, as far as practicable, all reflection and dispersion effects in and about the photometer by blackening all the surroundings of the instrument. Even in the best-constructed photometrical chamber, however, it is impossible to completely eliminate these effects; while in actual lighting their influence is more easily perceived than measured. The only other observation we have to offer here upon M. Blondel's suggestions is that, although the author at first recognizes, he subsequently ignores, the fact that, out of France, the so-called units of the "*bougie décimale*" and the "*bougie-décimale-mètre*" do not hold good. His appropriation of the term "*lux*," moreover, to mean the latter quantity, is unwarrantable, since it has already a meaning—the light-effect produced by a British standard candle at one foot distance.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Experimental Gas-Works.

SIR,—Although I am not in any way responsible for the article, on "Experimental Gas-Works," which appeared in your last week's issue, it is perhaps but natural that I should like to see the questions with which your remarks conclude, receive a satisfactory answer. My present object, however, is not to advance any suggestions towards a definite scheme, but simply to point out a somewhat obvious fact—viz., that if it is the opinion of those interested in the gas industry that the present opportunity is one which should not be neglected, no time should be lost in moving in the matter.

I would have wished that attention could have been drawn to this point without my intervention; but appreciating the importance of early action, I venture to address you, even at the risk of my meaning being misconstrued.

J. W. HELPS.

Croydon, Dec. 15, 1894.

The Danger of Modern Gasholder Practice.

SIR,—I read with much pleasure, in your issue of the 20th ult., the article on the above subject, and also your correspondents' remarks thereon. It seems to me the article is both timely and expedient; and it should be productive of much good.

Your readers may not be aware that, about eight weeks ago, an account was given in the *New York Herald* of the complete wrecking, during a heavy gale on Oct. 10, of a large gasholder having a capacity of 5 million cubic feet, two of the lifts of which were guided, and two shot out without guides. The extract from the newspaper reads as follows:—

The large gas tank being erected by the East River Gas Company at Vernon and Freeman Avenues was blown down and completely wrecked. When it fell, with a crash that could be heard for blocks, the greatest excitement prevailed. This tank, when completed, would have been the second largest in the world, and was to be 220 feet in height and 198 feet in diameter. The workmen had carried it up to about 200 feet. Had the mass tumbled in an opposite direction, it would have crushed upon a row of houses.

The word "tank" in the foregoing extract is evidently used in our sense of "holder." It is obvious that the holder must have been completed and filled with air or gas, or it could not have attained the height of 200 feet.

I am asking myself what is to happen to the gasholders that are being erected in this country without any guiding whatsoever, if in the future a severe storm should come upon us such as blew down the Tay Bridge. The velocity of the wind on that occasion could hardly have been less than that which proved so disastrous to the East River Gas Company's works.

INQUIRER.

Dec. 14, 1894.

[The holder referred to by our correspondent was described in the course of a full account of the East River Gas Company's works—prepared from *Progressive Age*—which was published in the JOURNAL for April 24 last (p. 764). In another part of to-day's issue, we reproduce the dimensions of the holder, with a general view of the works, showing its position, taken from the above-named publication.—ED. J. G. L.]

Unaccounted-for Gas.

SIR,—With reference to the above, the subject is one that demands a great deal of attention in the distributing department, which is not studied by some managers as to the best means to remedy the evil.

Leakage is an evil to some gas undertakings, because of the want of practical meter inspectors. What is a practical meter inspector? some may ask. The practical man can only be made from men who have been trained in the meter-repairing-shop and gas-fitting department, which is only carried out by some undertakings. Meter inspectors are generally made from men who have not received any experience in gas-works in any shape or form, except that they have been intimate friends of councillors and managers, and have been pushed forward because, in their ideas, if a man can read the index of a meter he is qualified for the post. This I contradict from experience obtained in following this stamp of inspectors, and noticing that they have not done their work in a capable manner.

For instance, I know an undertaking that has inspectors of this stamp, who try and see how many more visits per day they can make than their fellow mates; and so they scamp the work, instead of "inspecting" as they should do. When they pretend to water the meter they visit, they pour the water in anyhow; and the consequence is they very often syphon more water off than they put in, leaving the consumer to get some cheap gas. Then they order the meter off for standing; and the meter repairer calls their attention to it, that it is not standing—thus making the inspector for the future in some cases call a second time unknown to his master, so as to be certain the next time what he reports a meter standing for. He has watered it on the second visit, and finds the meter begins to register again; and he is puzzled how it is. If he asks whether they have been using any gas lately, the reply ninety-nine times out of a hundred is, "We have used very little." Some old meters have defective floats, and do not shut off when the meter gets low of water.

The meter inspector should be a man of practical knowledge and sound intelligence, that he may know what he is doing, and be able to advise consumers as to the best means of consuming gas, and pushing forward the business of his undertaking. The consumers will take more notice of such men as these than of men they know have not been brought up in the business. Then I believe the question of unaccounted-for gas or leakage may be remedied to a very large extent.

PRACTICAL METER INSPECTOR.

Dec. 15, 1894.

The Meter System v. Inspection for Detecting Waste of Water.

SIR,—In reference to "Waste Inspector's" letter on this subject in your issue for the 11th inst., I notice that the search for waste appears to have been made on a 9-inch main, 7500 yards long; that all supplies from this main by meter were shut off for six hours; and that, as a further check, all branches to side streets were also shut off. Will "Waste Inspector" be good enough to state (1) whether the 7500 yards of 9-inch main are divided by cocks into sections; (2) if so, whether, when making the observation dealt with in his letter, he shut off section by section, taking note of the effect on the waste-meter after each shutting; and (3) whether he commenced by closing the valve on the section farthest removed from the waste-meter, and worked backwards? If the 7500 yards of main are not commanded by cocks at intervals, I can well understand the difficulty of detecting a waste of 4 gallons per head in this particular case.

Dec. 12, 1894. A. J. A.

Improvements in the Sheffield Corporation Water Distribution System.—The Sheffield Corporation have adopted a recommendation of the Water Committee that larger pipes shall be laid down with a view of improving the water supply to Chapeltown and Handsworth. It is estimated that the cost will be £3504 and £861 respectively.

The Assessment of the Dudley Gas-Works.—At the meeting of the Dudley Board of Guardians on the 7th inst., the Clerk reported that the Assessment Committee had received notice of appeal from the Dudley Gas Company against their assessment. Mr. Foster (the Chairman of the Assessment Committee) said everything had been done to avert litigation; but the Company would not come to an amicable arrangement.

An Explosion at the Bakewell Gas-Works.—An explosion, which fortunately did not occasion much damage, occurred at the Bakewell Gas-Works last Saturday week. It appears that George Hayto had been cleaning out one of the purifiers; and had just taken the plug out of another (which was in use) when his attention was called to something outside. The purifying-house was immediately filled with gas; and as Hayto was about to return, there was a loud explosion, the escaped gas being ignited by coming into contact with the fire in a flue which runs from the retort-house, and in which there was a crack. The roof of the building was in places bodily lifted, and holes blown through it; but luckily it came down to its original position. Part of it rested on a beam, and was thus held up. From the plug-hole a stream of lighted gas was issuing; and though there seemed every probability of the place becoming a wreck, Hayto ran in, and, replacing the plug in position, removed further source of danger.

Bilston Gas Company.—The report of the Directors of this Company has been issued in view of the general meeting to be held on the 7th prox. They state therein that the profit and loss account, after paying the usual interim dividend, and defraying the costs of a lawsuit, shows a balance of £3715. From this amount the Directors propose to pay dividends of 5s. and 3s. 6d. per share on the "A" and "B" shares respectively; making, with the interim dividends, 10s. and 7s. for the year. The Directors deemed it necessary to appeal to Quarter Sessions at Stafford against what they believed to be an extravagant and unfair increase in the assessment of the mains in Lower Sedgley. They succeeded in obtaining some reduction, but at an expenditure of £738 in costs. The whole of this amount has been charged to the profit and loss account; thereby reducing to £1300 the sum carried forward. The colliers' strike entailed an extra expenditure of upwards of £800 on account of coal, which has been provided for out of the ordinary revenue. In consequence of the depression in trade, there has been a decrease of £573 in the sales of gas. These exceptional disadvantages might have been provided for by raising the price of gas; but the Directors decided to avoid this.

Novel Means of Disposing of Superfluous Water at Sheffield.—The Water Committee of the Sheffield Corporation are in the happy position of having more water than they require—in fact, they have a considerable amount actually running to waste. They have therefore come to the conclusion that they cannot do better than supply this water free to all the swimming-baths of the town, so long as, in the opinion of the Manager of the department, the stock of water is beyond what is necessary. The resolution the Committee have adopted on the subject, and which has been passed by the Council, reads as follows: "That, in order to encourage the use of baths, the Manager be authorized, occasionally, upon request, to allow any of the swimming-baths in the city to have a fill of water without charge, provided—(1) that this only be allowed when the Manager is satisfied that the department's storeage of water, having regard to the season of the year, is in excess of actual requirements; (2) that he report every such free gift of water, at once, to the Chairman of this Committee; (3) that the proprietors of the bath to which any such free gift of water is made shall, in any case, for that year, pay for water not less than the maximum sum paid by them in any of the then last three years."

The Stourbridge Gas Committee and Gas-Works Loans.—At a meeting which was held at the Stourbridge Town Hall on Monday last week (which, from the short report we have received, appears to have had some connection with the election of the Urban District Council), Mr. W. J. Turney, who presided, urged the importance of the Local Authority obtaining the gas-works loans at 3 per cent., instead of 4 per cent. If the whole of the local loans could be borrowed at the lesser rate of interest, it would, he said, mean a saving of about £2000 a year. Mr. W. Jones (the Chairman of the Gas Committee) addressed the meeting at considerable length on the gas undertaking, and explained how it was the Committee were unable to borrow money for the gas-works purchase at less than 4 per cent. This rate of interest, he agreed, was excessive; and he thought they ought to get the money at 3½ per cent. He urged that it should be a test question with parliamentary candidates whether they would support legislation to enable local authorities to borrow at ¼ per cent. more than the current rate of interest for Consols. Mr. Turney, in responding to a vote of thanks to him for presiding, remarked that he believed that, in the near future, they would all agree that what the Gas Committee had done had been in the interests of the town.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE, IRELAND—EXCHEQUER DIVISION.

Monday, Dec. 10.

(*Before Mr. Justice* ANDREWS *and a County Special Jury.*)

Alliance and Dublin Consumers' Gas Company v. The Corporation of Dublin.

This action was brought to recover £308 2s. for work in connection with certain alterations and repairs of the public lighting plant. The defendants lodged £32 in Court, and traversed the plaintiffs' claim.

Mr. W. KENNY, Q.C., M.P., Mr. J. GORDON, Q.C., and Mr. A. F. BLOOD appeared for the plaintiffs; the SOLICITOR-GENERAL, Mr. R. P. CARTON, Q.C., and Mr. P. O'C. WHITE for the defendants.

Mr. KENNY, in opening the case, said the action was to recover £308 2s., which was the amount of a running account between the parties, extending from Feb. 2, 1891, to June 30, 1894. The jury were no doubt aware that there had been prolonged disputes between the plaintiffs and defendants; and this action was one of the most important in point of principle. The defences raised several questions of fact and one point of law. The jury would have to try whether the work charged for was actually done; and, secondly, whether the work was done and the materials provided under contract. Another question would arise with reference to the price charged to the Corporation; and then another defence was specially pleaded. It was a defence founded on section 24 of the Gas-Works Clauses Act, 1871; and it was this: The Gas Company being what were called the undertakers, were bound to supply gas to any public body when the place to which it was to be supplied was at a distance of not more than 50 yards from their mains. That was the question raised in the special defence; and if there was anything in it, it only affected £20 of the claim. The defendants said the work and labour done, the materials provided, and the money paid, were (except as to the value of £32) done, provided, and paid by the plaintiffs in supplying gas to public lamps in the city, within the distance of 50 yards from the mains of the plaintiffs, in such quantities as the defendants, as the local authority, from time to time required to be supplied, and not otherwise; and that the price charged by the plaintiffs for all gas so supplied and settled by arbitration was paid for before the action was brought. The plaintiffs contended that the work for which they claimed was not touched by the 24th section. Their claim was not for the supply of gas. But from time to time lamps had occasionally to be moved from place to place, and lamps that were broken had to be repaired and replaced; and it was in respect of this class of work that the present action was brought. For 24 years, from 1866 to 1890, claims for this kind of work had been paid without question by the Corporation; and he would like to know how his learned friends proposed to differentiate between the items included in the £32 for which they admitted their liability and other items in the plaintiffs' account which stood upon exactly the same basis. As to the plea that, on the ground of public necessity, the Corporation were at liberty to call upon the Company to do these works free of expense, the Corporation might as well call upon any other contractor to alter the level of a street.

The SOLICITOR-GENERAL said it might shorten the case if he stated that the Corporation did not dispute the work done, nor its amount; but they controverted the price charged for it. The case would turn on a principle of law, which his Lordship would have to decide; and it had reference to the construction of section 24 of the Act of 1871.

Mr. KENNY said section 24 only affected a small portion of the case.

Mr. *W. F. Cotton*, the Secretary and General Manager of the Gas Company, examined by Mr. GORDON, stated that, before he was appointed to his present position, he was an Inspector of Lighting under the Corporation. He remembered the agreement as to these matters made between the Company and the Corporation in 1866; and accounts were furnished under the agreement similar to those now sent in, and they were paid without objection by the Corporation. That agreement was for ten years; and there was another in 1878 for, he believed, three years. The charges then made were on the same scale as those in the present account. The Corporation in one part of the account admitted certain items should be paid; and in other parts of the account, they denied liability for precisely similar items.

Tuesday, Dec. 11.

Mr. *Cotton* was cross-examined this morning by the SOLICITOR-GENERAL. He said that the Company in the present claim did not charge for putting in service-pipes within 50 yards of the mains for new lamps as referred to in the statute; but they did charge where lamps were shifted from one place to another, or where, having been discontinued for a time in one place, they were resumed in another place.

The SOLICITOR-GENERAL: You do not consider that you are entitled to charge for new lamps within 50 yards from the mains?

Witness: I do not say that. I think we are entitled to charge; but we do not charge in this account. That matter is in abeyance.

His LORDSHIP said that he supposed there would be subsequent litigation on that point; but happily they had nothing to say to the matter in the present case.

Witness was then examined at some length regarding various items in the account. One case specially referred to was the charge for a service-pipe to a new lamp at Smithfield. The Company, he said, made the charge because, having laid a service to a new lamp there, they were called upon to abandon it, and lay a new service-pipe to a lamp in a different place. The charge was for the second service.

By a JUROR: If a lamp was abandoned for some time, and was again resumed after the lamp was removed, he would not look upon that as a new lamp, and would not charge for a service-pipe to it. A new lamp he regarded as an additional lamp.

A JUROR said that he noticed several items in the account were marked "uncertified;" and he asked who was responsible for certifying that the work was done?

Witness: The Corporation Gas Inspector.

The JUROR: Then am I to understand that the money was not paid

to the Gas Company because an official of the Corporation neglected his duty?

Mr. CARTON said that was not so. They were not certified, because the Corporation were not bound to pay the items.

The case for the plaintiffs having closed,

Counsel on both sides addressed the Court on the legality of the charges.

His LORDSHIP held that the charges made by the Company were legal; and the only question for the Jury was as to the reasonableness of the price charged.

Wednesday, Dec. 12.

On the resumption of the proceedings this morning,

The SOLICITOR-GENERAL addressed the jury on behalf of the defendants. He said that his Lordship having ruled on the previous evening that the charges made by the Gas Company were legal, the only question for the Jury was whether the prices charged for the material were proper.

Mr. *T. J. Cotton*, the Gas Inspector under the Corporation, was examined, and stated that, in his opinion, the charges made by the Gas Company for material were unfair and unreasonable.

Witness was cross-examined by Mr. KENNY, with the object of showing that the charges made by the Company for material were not objected to before 1890, and that they were even then reduced to meet the views of the Corporation; also with the object of proving that the charges for work and labour were precisely what the Company paid their contractor, and in some cases the Corporation.

Mr. CARTON said he did not intend to proceed further, having regard to the expression of opinion by his Lordship, as really the amount now in controversy was so small.

A verdict for £307 18s. 2d. was given for the plaintiffs; but his Lordship granted stay of execution on the application of defendants.

Thursday, Dec. 13.

The case was again mentioned this morning.

Mr. BLOOD applied to the Court that costs should be allowed to the plaintiffs on the higher scale, having regard to the difficulty and importance of the case. He remarked that there were about 400 different items in the account, and 1000 different orders given by the Corporation, to be dealt with by the Solicitors; and they had to get ready proofs in every case, as they were all disputed by the Corporation.

Mr. CARTON argued, on behalf of the Corporation, that the case was not of sufficient importance to justify costs on the higher scale; and he quoted several English cases in support of this view.

His LORDSHIP said that the Solicitors for the plaintiffs might have been found fault with by their clients and by the Court, if they had not come fully prepared to prove a bill of £308, which was made up of small sums. This must have involved considerable labour and difficulty; and he would therefore allow the higher scale of costs, from the preparation of proofs until the case came into Court.

COURT OF SESSION—BILL CHAMBER.—Friday, Dec. 14.

(*Before Lord* LOW.)

Magistrates of Falkirk v. Falkirk Joint-Stock Gas Company and Others—The Question of an Overman.

The fresh application by the Magistrates of Falkirk against the Falkirk Joint-Stock Gas Company, Mr. E. Herbert Stevenson, Mr. Corbet Woodall, of London, and Mr. J. Barr, C.E., of Glasgow, to have respondents interdicted from proceeding in the arbitration to determine the price to be paid by the Corporation for the undertaking of the Gas Company, was disposed of to-day.

Lord LOW said: The prayer of the present petition is, so far as it goes, in identical terms with that of the note which was before me some time ago. The circumstances, however, have changed, in that a reduction of the nomination of Mr. Barr is now in Court; and that the complainers, in addition to the statements upon which they formerly asked for interdict, now aver that, if the Arbiters had known what had passed between Mr. Barr and the complainers, they would not have appointed him. As a reduction has now been brought, I do not desire to indicate any opinion with regard to the sufficiency of the complainers' averments to infer disqualification on the part of Mr. Barr to act as Oversman. But I may say, in reference to the opinion which I have expressed in the previous case, that the additional averment to which I have alluded appears to me to be one of importance, and requiring careful consideration. It is not disputed that the note must be passed; and the question is whether or not interim interdict should be granted. When the previous case was in the First Division, all the Judges indicated the view that to stop a statutory arbitration by interdict, was a very serious matter; and I think that the respondents are clearly entitled to argue, from the opinions delivered by the learned Judges, that, even if the action of reduction had then been brought, the inclination of the Court would have been to pass the note, but to refuse interim interdict. The complainers now argue that, if they are forced to proceed with the arbitration, they will, in the event of success in the reduction, incur serious loss and hardship. If the nomination was reduced, the result would be wholly to cut down the arbitration proceedings, because, by section 26 of the Lands Clauses Act, it is provided that the Arbiters "shall, before they enter upon the matters referred to them," nominate an Oversman. If the reduction, therefore, of the nomination would mean that the Arbiters had not performed that statutory duty, and if (as would necessarily be the case) three months had elapsed from the date of the submission, it would be imperative, under section 35 of the Act, to have the compensation settled by a jury. Not only, therefore, would the whole of the expenses of the proceedings be thrown away, but the parties would be prevented having the compensation fixed in the manner in which they have elected. If however, the complainers argued, the arbitration was stopped by order of the Court, it could not be said that the Arbiters had "failed" (the word used in section 35) to make the award; and it would be still open to them anew to appoint an Oversman. I confess that I was considerably impressed with the argument that the Arbiters could not be said to have "failed" to make an award, if they were prevented doing so by an order of the Court. But then I do not think that the interdict asked would have the desired effect. The Court is only asked to interdict Mr. Barr from acting as Oversman. But such an interdict would not prevent the Arbiters going on with the submission—indeed, I take it, they would be bound to go on—but it would prevent Mr. Barr being present when the evidence was being led, which I apprehend, he would otherwise be; and that certainly would be desirable, if the arbitration should devolve upon him. Further, the respondents say that they aver that the result of any interdict might be that the time specified in section 35 of the Act might expire without any final award; and that they would be thus forced to go to a jury. Now, I cannot regard that fear as altogether groundless, because, although I have a *primâ facie* opinion as to the meaning of the word "failed," the point is open to argument; and it is not a question which can be decided in this case, because it has not arisen. I have therefore come to the conclusion that I should not grant interim interdict. If the complainers fail in the reduction, then they, as well as the respondents, will benefit by the arbitration being allowed to proceed. If, on the other hand, the complainers succeed in the reduction, any expense that they will have incurred in the arbitration will merely be the price which they will have to pay for preventing Mr. Barr acting as Oversman; and it is for them to consider whether any advantage which they would thereby gain is worth that price. I shall therefore pass the note, but refuse interim interdict.

SHIFNAL POLICE COURT.—Friday, Dec. 7.

(*Before the Rev.* W. G. GARNETT-BOTFIELD *and other Magistrates.*)

The Shropshire County Council v. The Wolverhampton Corporation—The Expenses occasioned by "Extraordinary" Traffic.

This case was again before the Court to-day. It may be remembered that it was a claim by the County Council of Salop against the Wolverhampton Corporation for the sum of £174—expenses alleged to have been caused by the extraordinary traffic in the conveyance of coal to the Corporation water-works at Cosford. At the last hearing, the Bench decided that this traffic was extraordinary within the meaning of the Act of Parliament; and the case was adjourned for both parties to arrange the sum to be paid by the Corporation, or, failing this, for someone to be chosen to settle what the figure should be.

Mr. E. C. PEELE, the Clerk to the Salop County Council, said he was in a position to state that the parties had failed to agree upon the extent of the sum to be paid by the Corporation. They had therefore to go to arbitration; the gentleman selected as Arbitrator being Mr. T. Codrington, one of the Inspectors of the Local Government Board. He had made his award, and had fixed £163 as the amount which the County Council were entitled to receive; and he (Mr. Peele) had now merely to ask the Bench to make a formal order in accordance with that decision.

Mr. H. BREVITT, the Town Clerk of Wolverhampton, confirmed Mr. Peele's observations, and said that, as the Arbitrator had determined the amount to be paid, the matter was settled pending its reference to a higher Court. He would send in the usual notices, with a view to the Magistrates being requested to state a case, and would suggest that the draft case be submitted to Mr. Peele and himself. Then, if they could not effect a settlement, Counsel could intervene; and the case, when finally arranged, would be returned to the Magistrates' Clerk.

Mr. PEELE having agreed to these suggestions,

Mr. BREVITT applied for a case to be stated.

The BENCH made an order for £163, the sum determined by arbitration, and intimated that they would state a case for appeal.

The Winding Up of the St. Ives Gas Company.—Further proceedings in this matter (see *ante*, p. 1030) took place yesterday, with the result that the Official Receiver was appointed Liquidator.

Bradford Corporation v. Pickles.—The appeal of the defendant in this case from the judgment of Mr. Justice North, given on May 9 last, was allowed by the Court of Appeal on Monday last week. The arguments on the appeal were fully reported in the JOURNAL on the 13th ult. (p. 931); and the text of the judgment, which is to be appealed against, will be given next week.

Claim for Damages Caused by Leakage of Gas.—At the Bow County Court last Friday, before Judge French, Rachel Dowle, a married woman, carrying on business as a butcher at Rathbone Street, claimed damages from The Gaslight and Coke Company for a quantity of meat destroyed owing, as alleged, to the negligence of the defendants' servants. Mr. George appeared for the plaintiff; and Mr. Lewis represented the defendants. The plaintiff said that in July last she took a shop in Rathbone Street, and wrote to the Company to affix a meter there. When the gas was turned on the night the shop was first opened, it was found there was a very serious escape of gas. This caused all the meat to become black and putrid, so that it had to be destroyed. A plumber was sent for, and it was found that there was a leakage from the Company's main-pipe, which their workmen afterwards rectified. The alleged negligence was that the Company had fixed the plaintiff's meter to a worn-out pipe; and £20 damages were claimed for the loss of the meat. His Honour held that there had been no negligence, as the Company had sent workmen to remedy the defect as soon as they were informed of it. If they had not done this, they would have been guilty of negligence. There was no statutory obligation on them to discover a latent leakage when they put on a new meter; but they were bound to remedy it as soon as discovered. Judgment was accordingly given for the Company, with costs.

Damages against the Sheffield Corporation through the Negligence of Servants of the Water Department.—At the West Riding Assizes last Saturday week, Mr. Justice Charles and a Special Jury commenced the hearing of the case of Arnold *v.* The Mayor, Aldermen, and Burgesses of Sheffield; and it was concluded last Tuesday. The plaintiff—a builder, of Sheffield—sought to obtain damages from the

Corporation for injury alleged to have been caused to his property through the negligence of the defendants' servants. His case was that he erected two rows of houses in Bernard Street and Stepney Street; the streets being upon different levels, owing to the hilly nature of the ground. A workman in the employ of the Corporation Water Committee, while engaged in digging behind the property in the upper street, broke a water-pipe. Water was allowed to rush out of the pipe for three hours, with the result that the cellars of the new property were flooded, the "made-up" land between the two rows partially washed away, and the retaining-wall undermined. The Corporation defended the action on the ground of the faulty construction of the retaining-wall; and it was contended, on their behalf, that they had been guilty of no negligence in "pricking" the water-pipe, which was accidentally done while their workmen were lifting a flagstone. The strength of the defence was that the inherent defects of the wall brought it down. A great deal of conflicting evidence was given as to the design and construction of the wall, and as to the material of which it was composed. In the course of an exhaustive summing up, his Lordship pointed out to the jury that, up to the commencement of the action, no complaint was made by the Corporation as to the nature of the wall. The jury returned a verdict for the plaintiff for £118 12s.; and his Lordship gave judgment for the amount, with costs.

A Property Owner Fined for Allowing Water to be Wasted.—At the Lawford's Gate Petty Sessional Court yesterday week, Mr. F Whittaker was summoned by the Bristol Water-Works Company for having negligently caused or suffered a tap fixed at the rear of No. 10, Gordon Road, Whitehall, to be out of repair during the months of October and November, in consequence of which the water of the Company was wasted. There was a second summons against defendant for wilfully wasting the water. In stating the case, Mr. W. Henderson said defendant was the owner of a number of houses in Gordon Road, which were supplied with water by the Company. There was one tap at the back of No. 10; and that was the common source of supply for 16 houses, all of which were defendant's property. These houses were let at small weekly rentals to various tenants; and it was the custom of Mr. Whittaker to visit them on Mondays. He was going to prove that, for upwards of eight weeks, the tap had been out of repair to a very serious extent, so much so that over 8000 gallons of water had been running to waste daily. Although there was no obligation on the part of the Company to give any notice to the defendant, yet he received two notices calling his attention to the condition of the tap. No regard was paid to these till Dec. 3, when he put the tap in order. George Counsell, an Inspector of the Company, gave evidence to the effect that he examined the tap on Oct. 17, and found the water was running nearly full bore. On Oct. 30 and Nov. 7, he again visited the place, and found matters in the same state. Thomas John, the Chief Inspector of the Company, said his attention was called to the tap; and he saw it on Nov. 30. He estimated the quantity of water running to waste at not less than 8000 gallons a day. In the eight weeks that the tap was alleged to have been out of repair, sufficient water was wasted to supply ten families for a year. Two of defendant's tenants deposed as to the time the water was running to waste. In answer to defendant, they said that, during the eight weeks referred to by the prosecution, the tap was repaired two or three times; and once it was hammered up to prevent waste. Defendant said he could not keep the tap in order, because as soon as he had it put right, the children of the tenants damaged it. He had had 100 houses under his charge for fourteen years which were supplied with water by the prosecutors; and this was the first charge that had been made against him. The Magistrates considered the charge distinctly proved, and imposed a fine of 20s. and costs, or in default seven days' imprisonment.

Coventry Corporation Gas Supply.—During the six months ending Sept. 30 last, 125,436,000 cubic feet of gas were made at the Coventry Corporation Gas-Works, which was an increase of 9,964,000 cubic feet, or 8·63 per cent., upon the corresponding period of last year. The number of consumers on Sept. 30 was 5962, which is a decrease of 86; and there were 1415 cooking and heating stoves on hire, which is an increase of 45.

St. Austell Water Supply.—Nine tenders were sent in for the construction of a new reservoir for the St. Austell Local Board. The highest was £5619; and the lowest, £1814. The Local Board a short time since accepted the lowest tender—that of Mr. T. J. Smith, of St. Austell. Mr. Smith has since written to the Clerk to the effect that he had inadvertently omitted the cost of constructing two filter-beds. If this is added his tender will still be about £200 less than the next lowest, which was £2490. There were seven tenders for trenching, laying, and completing the mains; and that of Messrs. Francis and Sons, a local firm, was accepted—the amount being £610.

Further Trouble at the Eccup Reservoir of the Leeds Corporation.—The engineers and others concerned in the works which are to remedy the leakage of water from the Eccup reservoir of the Leeds Corporation have lately met with a fresh difficulty. The progress made had been such that it was hoped that within a few days the trench being sunk in the embankment would be satisfactorily completed for its whole length. About a fortnight since, however, the bottom of the trench was suddenly blown up by the pressure from an underground spring, which discharged into the trench more than 300,000 gallons of water a day. The City and Water Engineer (Mr. T. Hewson) reported to his Committee last Friday that the inflow of water had been reduced to about 160,000 gallons per day. The advent of the water at that particular spot showed that a soft pervious stratum crossed not only the trench at the point he was working, but the remainder of the embankment, which, until now, it was hoped would not have to be taken up. It was intended to sink another 4 feet at that end of the trench. Mr. Hewson added that there was nothing abnormal about this inflow of water, nor did it involve any great difficulty in being dealt with, since it amounted to less in quantity than occurred in the most ordinary cases; and that, in dealing with it, no change whatever had had to be made in the pumping arrangements previously provided for such a contingency. He reminded the Committee that the pumps had been working for over two years at that part of the embankment which had been completed.

MISCELLANEOUS NEWS.

CONTINENTAL UNION GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held on Tuesday last at the London Offices, No. 7, Drapers' Gardens, Throgmorton Street, E.C.—Sir JULIAN GOLDSMID, Bart., M.P., in the chair.

The SECRETARY (Mr. F. W. Himing) read the notice convening the meeting, the following report of the Directors, and the statement of accounts for the year ending June 30 last:—

The Directors have to report that at Messina and Montargis—the two stations belonging to the Continental Union Gas Company—the number of consumers on the books of the Company is now 3508; being an increase of 259 over the previous year. The consumption of gas at these two stations shows an increase of 5 per cent.

The continually increasing consumption of gas at Messina has rendered necessary a further expenditure of capital, amounting to about £4500, for the year ending on the 30th of June last. This expenditure was mainly on purifiers, benches, mains, and services. The sum of £359 has also been expended on capital account at Montargis for cost of main to the Hamlet of Chalette, new lamps, services, &c.

The total bad debts incurred and written off the profits amounted to less than £90.

Turning to the stations belonging to L'Union des Gaz, the net outlay on capital account during the working year 1893-4 amounted to £37,228, including purchase of new land and houses at Milan and Rueil, a new telescopic gasholder at Alessandria, additional benches of retorts at Genoa, Milan, and Rueil, regenerative furnaces at Strasburg, and new mains lamps, and services generally at the thirteen stations.

The following statistical information relating to the working of the Union des Gaz stations is, as usual, given here: There has been an addition of 513 to the number of public lamps supplied with gas during the year. The net increase in the number of private consumers on the 30th of June last was 3884; being at the rate of 5½ per cent. The quantity of gas sold has not, however, followed the same rate of progression; being only a little over 1 per cent. This fact is partly to be attributed to the continually increasing use of the Auer incandescent burner, which, while enabling the Company to compete with success in many instances against the introduction of the electric light, has the effect of considerably reducing the quantity of gas consumed. The average price of coal has decreased about 1s. 6d. per ton; but this advantage has been more than counterbalanced by a fall in the value of coke to the extent of 3s. per ton. Tar also shows a decrease in value of 1s. 7d. per ton; but ammoniacal products, on the other hand, give a trifling increase of 2d. per ton of coal distilled. Bad debts incurred and written off profits amounted to £669; being at the rate of 2¼d. for every £10 of gross rental.

The Union des Gaz has succeeded during the year in prolonging the Concession of Nanterre, near Paris, until the year 1935, on condition of a reduction in the price of gas.

As will be seen from the balance-sheet of the Continental Union Gas Company, the Directors have during the year invested £12,400 of the Company's surplus funds in the purchase of 500 shares of the Anglo-Romano Gas Company. The total of the Company's investments amounted on the 30th of June last to about £110,000 in addition to £21,000 cash on deposit.

The Union des Gaz accounts show that that Company has suffered considerably during the year from the increased rate of exchange on its remittances from Italy, and from reductions in the price of gas at Milan, Nimes, Cette, Rueil, and Genoa. They have, therefore, only been able to pay their former rate of dividend of 80 frs. per share.

The profits of the Continental Union Gas Company have also suffered to a considerable extent from the rise in the rate of exchange on its remittances from Messina, and from the reduction in the price of gas at Montargis, consequent on the prolongation of the concession.

After making the usual charges and reserves, the net profits of the Continental Union Gas Company, Limited, for the year amount to £116,294. The available sum to the credit of general revenue is £154,290, out of which the Directors recommend a dividend at the rate of 13 per cent. per annum. The holders of 7 per cent. preference stock participate *pro ratâ* in all ordinary dividends exceeding 10 per cent., and will therefore receive 10 per cent. for the year. It is proposed that, after deducting the interim dividend, paid in July last, of 5 per cent. on the ordinary and of 3½ per cent. on the preferential stock, the balance of 8 per cent. on the former, and 6½ per cent. on the latter, all free of income-tax, should be paid on Jan. 4 next. The amount carried forward to the new account will be £38,090.

The Director who retires by rotation is R. Hesketh Jones, Esq.; and the Auditors (A. T. Eastman, Esq., and I. A. Crookenden, Esq.) also retire. All these gentlemen, being eligible, offer themselves for re-election.

The CHAIRMAN said that, in moving the adoption of the report and accounts, he did not propose to address the proprietors at any length, for two reasons: First of all, there was nothing very new to tell them; and, secondly, he had recently acquired a most undesirable property—a very bad cold. The state of the Company's affairs was clearly set out in the report. The Union des Gaz, in which they were important shareholders, were not able to declare an extraordinary dividend as they did last year; and they had returned to their ordinary rate. Therefore the Continental Union Company had practically received the same amount of profit as they did in previous years other than that of 1892-3. As far as it went, under all the circumstances of the case, he was of opinion—and he thought the Board generally were of opinion—that that was not an unsatisfactory result, because business had not been very prosperous anywhere; and there had been circumstances in several of the towns the Company lighted which had been eminently unfavourable to the expansion of gas lighting. There was no doubt, as stated in the report, that the growing use of the Welsbach burner had, in many cases, put a considerable check upon the extension of the use of the electric light. There was, of course, the compensating disadvantage of this burner, that it gave an intensified light, with a reduction in the consumption of gas. But it was better to have the Welsbach burner with a smaller consumption of gas, than the electric light with no consumption at all. Altogether the business appeared to him to be upon a sound footing, both as far as the Union des Gaz was concerned and their own Company. The Directors had given every attention to the work of the past twelve months; and he was satisfied that the general condition of all their property had been well maintained. Every year one of his colleagues visited the stations; and from time to time some of the others called in at the works when occasion arose. Consequently, they had personal supervision, as well as trustworthy agents and engineers in charge, of the different stations;

and, on the whole, the business was well looked after, and the results were satisfactory. It was mentioned in the report that this year the Directors had purchased some shares in the Anglo-Romano Gas Company—that was, the Company lighting the city of Rome. They had the opportunity of buying the shares at a very low price; and to prove the wisdom of this purchase, he might state that, since they bought them, their market value had risen £2. The investment was a most legitimate one for a gas company to make; and he hoped it would turn out a profitable one for them. He had noticed during the past 25 years that there was a possibility of legitimate investment for gas companies in good businesses of other gas companies; and it was a policy he had promoted very largely, and which, on the whole, had been productive of exceedingly satisfactory results. He had seen it in several cases, because they not only invested the money in the business to which their money was intended to be devoted, but it also gave them the opportunity of sometimes exercising legitimate influence in the affairs of those gas companies, and promoting economical working, while the welfare of the town was considered. Therefore this system of investment was a very satisfactory one for gas companies. With regard to the business as shown by the balance-sheet, the practical result was much the same as last year, if they put out of account the extraordinary dividend of the Union des Gaz; and so they were prepared to declare the same dividend as last year. The extraordinary dividend referred to was devoted to the writing down of the stock held by the Continental Union Company to par value, which was the legitimate employment of this profit. There were one or two other matters to which he should like to allude. No doubt the proprietors had all seen in the papers an account of the disastrous earthquake which took place in Messina. Fortunately, the Company's works had not suffered, though it was possible that some of the mains might have been disturbed; but they would only be able to find out whether or not this was so as time went on. On the whole, however, it was a source of satisfaction to note that they had not sustained any immediate loss by this disastrous event. Another point which called for remark was an announcement in the papers that day, which, he thought, was a matter of serious concern for any company interested in Italian gas-works. He did not know whether any or all of the proprietors had read the budget of the Italian Finance Minister as reported in the papers; but they would find that he expatiated upon the economies which the Italian Government were endeavouring to accomplish, in order to arrive at an equilibrium with their budget, and he referred to proposals for increased taxation, which always accompanied this idea of economy. In the course of his speech, the Italian Minister proposed to impose a small tax on the consumption of gas and electric light by private persons. For some time past, they had been concerned by reports upon this subject; and they had done what they could to lay before the authorities the exact position of affairs regarding gas companies. There was no doubt that gas companies, in entering into contracts with the various municipalities, considered the taxes they would have to pay; and consequently the Imperial tax they would have to pay in this way would be over-riding the taxation upon which they had based their tenders, and would be unfair to the companies concerned. It would be all very well if they could add the increase to the bills of their consumers; but they did not know whether or not that would be so. This was a subject upon which a great deal might be said. But they had not received much information with regard to it yet; consequently, he would confine himself to these few observations, assuring the proprietors at the same time that the Directors would give every attention to all that could be done in their interest upon this important subject. This was all he had to report upon in reference to the Company's business. Though some people still thought the days of gas companies were numbered, he had never expressed himself in that direction. He believed the usefulness of gas, not only for lighting, but also for heating and industrial purposes, was being proved to a greater extent day by day; and he was quite certain there was a good future before them, if they were only ready to follow all the serious indications of public demand.

Mr. N. E. B. GAREY seconded the motion.

Mr. T. A. GREENE asked the amount of loss on exchange.

Mr. J. WATSON said he noticed that the shares in the Union des Gaz were marked in the accounts at their par value of £20 each; and he inquired what was their selling value in Paris or elsewhere where they were quoted on the Bourse.

The CHAIRMAN, in reply, said that the extraordinary profit which was made the year before by the Union des Gaz was principally owing to the high price of coke, which made a difference of £20,000, and to the more favourable exchange, which made a difference of £10,000. Exchange in Italy had been unfavourable during the greater part of the past year; and this was one of the reasons why the Union des Gaz had not been able to pay any extraordinary dividend. During the last month or two, the exchange had improved; and the prospects of Italian finance seemed to be more favourable. However, as he was not an authority on Italian finance, he would not commit himself on the subject. Regarding the prices of the Union des Gaz shares, he had known them at £64, £65, and £66. They varied a good deal, just the same as the price of shares varied here, according to the rate of discount with the Bank of France. Of course, the extraordinary dividend caused a certain rise of price, which had not been maintained. The value of the Union des Gaz shares was far in excess of the amount at which they stood in the balance-sheet, which must be very gratifying to all the shareholders.

The motion was unanimously carried.

On the proposition of the CHAIRMAN, seconded by Mr. F. TENDRON, the dividends recommended in the report were declared.

The CHAIRMAN then moved the re-election of the retiring Director (Mr. R. Hesketh Jones); and the motion, having been seconded by Mr. A. LUCAS, was adopted.

Mr. W. T. SHORTHOSE proposed the re-appointment of the Auditors (Messrs. A. T. Eastman and I. A. Crookenden).

Mr. GREENE, in seconding the proposition, said that the subject of exchange, upon which he had asked a question, was really, to his mind, a much more serious matter than, judging from the attention usually devoted to it at meetings in the City, it was generally considered to be. They knew that their dividends were less than they should be, by reason of the low rate of exchange. He was a very strong bimetallist; and there were a great many men who thought the same as himself. In his opinion, gentlemen who were auditors of companies ought to devote their attention to, and thoroughly understand, this question. Without going into the subject of bimetallism, he suggested that a resolution should be framed, and sent to the Home Secretary, or whoever was the proper member of the Government, asking him to convene an international meeting to discuss the rehabilitation of silver.

The CHAIRMAN remarked that he was very strict with regard to the limits he allowed speakers in order to keep them to the subject before the meeting; but the last speaker was a gentleman whom they respected, and therefore he was unwilling to curtail his remarks. He (the Chairman) could honestly say that, in his opinion—and he had had some experience in this matter—the Auditors could not possibly have any control over the rate of exchange. All they and the Directors could do was to take it as it came.

The motion was agreed to.

The CHAIRMAN next proposed, and Mr. H. WOLLASTON BLAKE seconded, a vote of thanks to the Engineers, Managers, and other officers, and the staff of both the Union des Gaz and the Continental Union Company.

The resolution having been passed,

Mr. H. D. ELLIS remarked that there was another duty which they had to discharge, and that was to return a vote of thanks to the Chairman and Directors for their able conduct of the Company during the past year. He thought this was peculiarly due on this occasion, because, as the proprietors had learnt from the Chairman's speech, things had not been so *couleur de rose* as they had been in former years. He saw from the Union des Gaz accounts that their receipts had dropped off by about half a million francs, and that exchange showed an increased loss of something like 280,000 frs. The price of coke had fallen considerably abroad; and the loss of profits of the Union des Gaz was chiefly attributable to that. The Directors must have had a very anxious time indeed; and he congratulated them and the proprietors upon the position of their affairs.

Mr. R. STEVENS seconded the motion, which was heartily agreed to.

The CHAIRMAN said he and his colleagues were very grateful to the proprietors for their vote of thanks, and for the friendly words which had fallen from the mover.

This concluded the proceedings.

SOUTHWARK AND VAUXHALL WATER COMPANY.

The Half-Yearly Ordinary General Meeting of this Company was held last Tuesday, at the Offices, Southwark Bridge Road—Alderman Sir H. E. KNIGHT in the chair.

The SECRETARY (Mr. Alfred Jelley) read the notice convening the meeting, and the minutes of the last general meeting.

The CHAIRMAN referred, with great regret, to the loss which the Directors and the Company generally had sustained by the death, last Saturday, of Mr. Henry Whiting, who was a Director of the Company for more than forty years. He proposed a resolution expressing regret at the death of Mr. Whiting, and condoling with his relatives.

Mr. ILSLEY, in seconding the motion, observed that the late Mr. Whiting was formerly Chairman of the Company, and he invariably discharged his duties with ability, and with the utmost courtesy to the shareholders.

The resolution was carried unanimously.

The CHAIRMAN then proposed the adoption of the report and accounts. They had, he said, had a very successful half year; and the Company's affairs were looking as prosperous as one could expect them—considerably more so than at this time last year. They had been fortunate during the half year in greatly reducing the charges for maintenance, as compared with what they were a year ago. The total saving under this head was £1159. Referring to the items which came under maintenance, he found that in the charges for maintenance and repair of mains, pipes, fittings, meters, and works connected with distribution, there was the very important saving of £1785. There had also been an economy of £187 in the cleansing of filter-beds, &c.; and a saving of about £500 in the item of filtration, including cost of materials and labour. There would therefore really have been a total saving of £2500 in these three items, but for the fact that there had been an extra oulay in certain other directions. On pumping and engine charges, the increase in expenditure had been £290, caused chiefly by the larger quantity of water they had pumped in the half year. To the Thames Conservancy, also, they had paid £345 more. He would explain this item later, when he came to deal with the Thames Conservancy Bill. Their old enemy, rates and taxes—the amount of which was higher every time he addressed them—showed an increase on the present occasion of £760; and under this heading, they had paid in the half year £12,324. Deducting the extra expenses from their savings, they were left with £1159 to the good, as he stated at the beginning of his remarks. Under the head of management, the figures were so nearly the same as they were a year ago, that there was no necessity for him to call attention to any particular item. On the other side of the revenue statement, he had to refer to the increase in the amount of bad debts, which were set down at £1356, against £656 in the corresponding period of last year. The items of bad debts, overcharges, and allowances for empty houses had half year after half year been gradually reduced, owing to more improved supervision, and the general care exercised in collecting the revenue. The large increase in bad debts might therefore have been rather startling to the proprietors when they took up the accounts; but it was caused by what he supposed he must describe as an oversight, for out of the £1356 shown no less than £700 was due to an abnormal cause. Had it not been for this, they would have seen the same reduction under this heading as they had been accustomed to observe for some years past. Unfortunately, during the past half year, they had had another loss in the person of their Chief Accountant, who had served them for many years with great rectitude and advantage. They had had to appoint a new Chief Accountant, to whom he supposed the old adage of new brooms sweeping clean applied; for he discovered that the water-

rates in the hands of collectors for collection—which stood in their balance-sheet last year at £980—did not correspond with the sum which was actually collectable. In other words, amounts which had been given up as bad and past collection had not been taken out of the accounts, and had gone on accumulating and accumulating, until it was discovered that there was nothing left but to write them off. It was of no use bringing them forward as collectable when they knew they could not be obtained. The £700 mentioned, therefore, had been written off; and in account No. 5, it would be seen that the item of water-rents in the hands of collectors for collection now stood at £377 only, against £980 a year ago. That was the explanation of the increase in their bad debts. He was very glad that they had discovered the oversight; but it was one of those matters which might very easily pass. They would take care that nothing of the kind occurred again; and the sum which was really collectable would have to tally with the amount in the hands of collectors for collection. The water-rents accrued to the date of the account amounted to £118,821, against £119,148 a year ago, and £111,345 last March; so that on the six months to last March, there had been an increase in the half year under review of £7476, although there was a decrease of £327 in the item now as compared with the amount shown at September, 1893. This was not a matter that should give them any ground for dissatisfaction or alarm, because the decrease was owing to the lessened consumption of water by meter, on account of the wet summer this year. On the meter account, in fact, there was a deficiency of £1400 or £1500; but on the other hand—and this was the mark of prosperity—there was an increase in their income from new houses large enough to make up for the whole of the deficiency caused by the loss of meter-rental, except the small sum of £327, which he had mentioned. They had £65,606 to carry to the transfer of profits account, against £64,441 at this time last year. With the amount brought forward from the past half-year's accounts, and the interest on their parliamentary deposit, they had a total of £67,571. After providing for the debenture stock interest and the dividends on the preference stock, they had a balance applicable to dividend of £36,030, out of which they proposed to pay their usual rate of dividend—namely, 6 per cent. per annum, which would absorb £30,861, leaving them, in round figures, about £5000 to carry forward. This was an exceedingly satisfactory condition of things; and considering the large amount they had to pay for parliamentary expenses in defending their interests, which were always being attacked in an unscrupulous and unfair manner—he thought they had every reason to be satisfied at the manner in which their accounts had come out, at the dividend they were enabled to pay, and at the balance they could carry forward. During the past half year, no fewer than 827 new supplies had been brought into account, which were estimated to produce an increased annual rental of £1660. Their new works at Streatham were practically finished; and he hoped that they would be available in a few weeks time. They had done all that was necessary to maintain their plant and works in good order and an efficient condition. They might remember that the Company promoted a Bill in Parliament during the past session, which received the Royal Assent. He heartily congratulated the Company on their success in obtaining this Act. They had had the most severe opposition to contend with—opposition, he might say, from everyone who could possibly oppose them, and very virulent opposition from the London County Council. In spite of all this, however, the matter was so clearly and forcibly placed before the Committee of the House of Lords, that they not only gave the Company everything they asked for, but regarded their case as so urgent that they put in an unusual clause—namely, that the works about to be constructed should be commenced immediately. He must say that in preparing their plans they had strictly followed the recommendations of the Royal Commission on Water Supply in 1893. They had constructed reservoirs in positions and places which the Commission had recommended; and everyone was satisfied that the works they proposed to construct were not only the most economical, but also the most successful for the service of their district. All that they had to do was to persevere steadily in the course Parliament had ordered them to take; and he thought there was no doubt that in due time they would be able to construct all their works, and put the Company into a position they were bound to be put in after the report of the Royal Commission. They would thus add materially to the prosperity of the undertaking, and strengthen their position under any circumstances. The Bill as promoted by the Thames Conservancy contained a great deal that was very objectionable to the Water Companies, and would have imposed hard conditions on them, which would have weakened their position. These matters were thoroughly thrashed out before the Committee of the House of Commons; and in the result the Thames Conservancy consented to certain amendments of their original plan. This left the Water Companies without any damage, or anything that they could possibly complain of, except that the payment which they had to make to the Thames Conservancy every year was increased. The Thames Conservancy proposed in their Bill to make an extra charge on each of the Companies of £3000 a year for the privilege of taking water from the Thames. Had the Bill passed without any opposition from them, their Company would thus have had to pay no less than between £6000 and £7000 a year to the Thames Conservancy; whereas the amount of £3000 odd which they were already paying had been increased by £1375, one-fourth of which represented the extra sum appearing in their accounts as having been paid during the past half year. He might say, as regarded this Bill, that the Thames Conservancy behaved in the most honourable and straightforward way.

Mr. C. M. VIALLS seconded the motion.

Mr. NORRIS, having referred with great regret to the death of Mr. Whiting, alluded to the small dividends paid by the Company compared with those of the other Companies, and the low price comparatively at which their stock was quoted on the market; and he said he was quite sure the Chairman would be able to give him an explanation on these points. The accounts appeared to him to be prepared in a very excellent way. He would like to know how they intended to allot their stock which was undisposed of. He was very glad to find that their last Bill had been passed so successfully; and he would take that opportunity of thanking Mr. Ponsonby, on behalf of the shareholders, for his services to the Company in the House of Commons. He was sure that the shareholders warmly appreciated the services of the Chairman and Directors.

Mr. JEFFRIES expressed his sympathy with the remarks which had fallen from the previous speaker. He desired to ask whether the parliamentary deposit had been released. He urged the Directors to appeal against the increased rates and taxes wherever they thought it likely that they might succeed; and he had no doubt that they would receive proper consideration. Seeing the strong financial position of the Company, he had hoped that on the present occasion they would have a small increase on their dividend—to 6½ per cent.; and he thought the Directors might very properly have paid such a dividend.

The CHAIRMAN, in reply, stated that with regard to their dividend being less than that of other Companies, this was not a matter of surprise considering the circumstances. The other Companies had much better districts to supply than they had. The average rate in the case of the other Companies would be, perhaps, £5 or £6 per house; whereas in their own case, it was only 24s. Their plant was also larger; and the houses being more numerous, the consumption of water was greater. They had had to be for years at far greater expense for plant than other Companies more favourably situated; and the latter also possessed larger powers of charge than they did. Instead of being limited to 4 or 5 per cent., as their Company were, some of the Companies could charge as much as 7½ per cent. All these advantages very materially diminished the expenses and the outlay of capital, and enabled a larger profit to be distributed to the shareholders. They had looked into this question thoroughly time after time; but he could not find any weak point in their working which would enable them to diminish their expenses or increase their revenue beyond that which would be caused by the normal increase in the number of houses in the district, which, however, would bring with it additional expense. They must also remember the financial difficulties which, ever since he had been a member of the Board, the Directors had had to face. Before he joined them, the works had not been constructed as well or as efficiently, or to the extent which they ought to have been; and these arrears had had to be pulled up, involving a large expenditure of capital, which ought to have fallen on the shoulders of those who preceded them. The proprietors might rely upon everything being done for them which would increase their dividends, and bring them up to the level of the other Companies. So far as he himself was concerned, he never had the interests of the Company out of his thoughts. Their system of working was extremely good; and they collected over 99 per cent. of their rates. In regard to their rates and taxes, at every quinquennial valuation, they were attacked on all sides, and everyone tried to impose some burden on them. They resisted this wherever they thought it likely they might succeed; and in a long series of years, they had prevented many thousands of pounds from being added to their assessment. Years of practice seemed to have settled the mode of assessing the rating of water companies. He did not say that it was a fair or right way. But custom had settled it; and they could only fight when they thought they were being wronged. Their principle was to buy coal and everything else by contract as far as possible. With regard to the issue of new capital, they had at present £13,887 unexpended of the capital they raised a year ago. He believed that this would carry them on, with other financial arrangements; and he did not think they would be under the necessity of issuing more capital for the next six months. They must, however, be prepared for doing so, because they had a large amount of work to execute. The parliamentary deposit had been paid off. They deposited 2¾ per cent. Consols, which they had sold at a considerable profit over the sum they paid for them; and this money had been paid into their bank.

The motion was then unanimously adopted; and resolutions were afterwards passed declaring the dividends recommended, giving a donation of 20 guineas towards the maintenance of the Hampton Schools for 1895, and re-electing the retiring Directors and Auditor.

A cordial vote of thanks to the Chairman and Directors terminated the proceedings.

GRAND JUNCTION WATER-WORKS COMPANY.

The Half-Yearly General Assembly of this Company was held last Wednesday, at the Offices, South Molton Street—Mr. FRANCIS TAGART in the chair.

The CHAIRMAN said that, before they began their business, it was his painful duty to inform them that they lost on the previous Saturday their old and valued friend Mr. Henry Whiting, who was connected with the Company long before any of the other Directors—he believed for about 34 years. The deceased gentleman was interested in other water undertakings besides their own; and his experience had been of great value and assistance. The Board had lost a most excellent colleague; and the shareholders had lost a Director who looked after their interests closely and diligently on all occasions.

Lord KNUTSFORD stated that he joined the Board in 1875; and perhaps they would allow him to add a few words to what the Chairman had said, as he (the speaker) had been a Director for a longer time than any of the other members of the Board. When he joined the Company, matters were certainly in a very unsatisfactory state; and Mr. Whiting, with energy and great ability, was overhauling their affairs. He instituted great reforms, modified the accounts, and effected large economies. At the same time, the working capability of every man in the office was tested; and several who had not been doing their work were dismissed, and others appointed in their places—a change by which the Company had benefited. Mr. Fraser, whose excellent work had been so advantageous to them, was also appointed Engineer about the same time—in 1876. He had ventured to make these remarks, because probably the shareholders were scarcely aware of the great debt they owed to Mr. Whiting, who faced, with a boldness which everyone did not exhibit, that odium and those attacks which every reformer must be prepared to face if he intended to do good.

The SECRETARY (Mr. J. Goodwin) then read the notice calling the meeting, and the minutes of the last general meeting.

The CHAIRMAN said that in asking the proprietors to adopt the report,

there was nothing in the accounts requiring any special remarks. He could have wished that it were otherwise in this respect—that their water-rental had shown a more rapid increase. It was only about £300 more than the previous half year. Nevertheless, if they looked back for the last two years, they would find that their progress had been fair, although slow. On the debit side of the account, the items of maintenance, pumping, and filtration showed no great difference, as compared with the corresponding period of last year; and, in fact, it was only when they came to the charge for rates and taxes and for the Thames Conservancy that they found any material increase. The taxes they were almost hopeless about, although they did their best to keep them down. With regard to the Thames Conservancy, the present payment included the first portion of the increased charge they had to pay now; and a larger sum would appear in their next accounts. He regretted that for this increase they had very little; he must not say that they obtained nothing, because the eight Water Companies were allowed to have one seat on the Thames Conservancy Board. This was not much among so many Conservators; but it enabled them, at any rate, to be heard. They would be pleased to hear that, through the courtesy of the other Companies, Mr. Tendron had been elected to that post. In the presence of their colleague, he would simply say that in him they would have an able and energetic representative. Returning to the accounts, he would call attention to the certificate of the Auditor, to the effect that there was a balance of £50,543 available for dividend, from which they proposed to divide at the rate of 8½ per cent. per annum on the ordinary stock, the same as last year. As to the works, they had been maintained in the same good order and condition as previously. Last year they had a season of remarkable drought; and in the past month they had had floods which beat the record of a century. But their works suffered no material damage; and, having a good stock of coal, they were in no way inconvenienced. Since the last meeting, the proprietors might have observed that some of the large Water Companies had obtained the sanction of Parliament for the execution of increased storeage and other works. On the second reading of those Bills, Lord Balfour, in the House of Lords, made a remarkable speech, in which he strongly emphasized the result of the Royal Commission, and trusted that an effort would be made soon to bring in some comprehensive scheme founded on the lines of the recommendations of the Commissioners. From the fourth paragraph of the Directors' report, it would appear that they did strive to join, and would have been very glad to join, in some General Bill with the other Companies; but unfortunately they failed. At the same time, their ideas on this matter were not thrown aside lightly, or without due consideration by the other Companies, although the fact remained that they were now contented to rest on the powers they had obtained. By the process of double filtration thoroughly carried out, they had been able to supply all their districts abundantly with water that had satisfied the views of their Analytical Chemist. After the strain that was put on them last year, it might have been expected that they would this year supply their customers properly; and they had done so—giving them an abundance of water for all purposes. Nevertheless, in course of time, they might also find it expedient or necessary to construct large storeage reservoirs near their own works, for which, with the shareholders' consent, they had the means; and they also had land very eligible for the purpose. Still, it would be more economical and more satisfactory, if they could have brought about, or could bring about, a combination of the other Companies, so that reservoirs might be planned and executed upon the lines indicated by the Royal Commission; because in that way they would certainly obtain powers for taking a larger supply of water from the Thames—a course which the report of the Commission showed might be done at certain times without in any way detracting from the beauty of the river, or being any disadvantage to any place or person. They might expect him to say a few words respecting the attack that had now been made by the London County Council upon all the Companies. It occupied not a single column, but a whole page of *The Times*. He doubted if it would be an advantage, or in any way of interest, to the ratepayers; but this he knew—that it was intended to, or would harass and annoy the Directors and the staff, and put the shareholders to considerable expense, by their having to deal with these Bills separately. How this was to be followed up, they hardly knew until that morning, when it appeared that the County Council had decided to proceed with all the Bills. The Company were not desirous of parting with their property. Still, if they were bound to do so to a Water Trust, or even to the London County Council, they could not object, if the matter were referred to arbitration; but the arbitration must be perfectly fair and straightforward, and not an arbitration where some other word was concealed under a very thin disguise, and where one of the Arbitrators was to be bound down, and the other was to have the power to dictate and define the conditions of that arbitration. He thought, however, they might trust to the penetration of a Committee of the House of Commons not to allow confiscation to creep in stealthily and in an underhand way, because they must know that it would be a fatal blow, not only to the Water Companies, but also to every commercial enterprise in the country, and every great undertaking that had been entered upon on the faith of an Act of Parliament. The Directors would watch closely the Bills and all other matters relating to the shareholders' interests. He concluded by moving—"That the report of the Directors and the statement of accounts be approved and confirmed, and that the recommendations contained therein be adopted."

Lord KNUTSFORD seconded the motion.

Mr. SLATTER observed that the Directors clearly foresaw what might happen in connection with the latest attack of the London County Council; and they would therefore be forewarned, and would take care to have a strong voice in the appointment of an Arbitrator. No one must be admitted as an Arbitrator who was not perfectly fair to both sides. Their interests were much too large to be frittered away by a body which took its expenses out of the pockets of the ratepayers, whereas the Companies would have to pay their costs out of their own pockets. As regarded the question of expenses, it did not matter to the County Council whether they succeeded or failed. If they would undertake to pay something like the market value for the property of the Companies, the latter would possibly not raise any strong objection. The London County Council had not had the making of this valuable property; and they forgot how many years it was before the shareholders took anything like their present amount of interest. Moreover, those who had bought their shares in late years were not receiving such a large return. Though they were being attacked all round, their business should be not to sell their shares, but to hold them; and if the time came when the assistance and support of the shareholders were needed, they should back up the Directors in struggling for an adequate return for their property. He assumed that a letter of condolence would be sent to Mrs. Whiting.

The CHAIRMAN replied in the affirmative.

Mr. TENDRON, in answer to Mr. Slatter, remarked that they might have the most able men appointed as Arbitrators; but if they were given particular instructions, their ability became of no avail. What he thought the Water Companies had to protest against so strongly was the audacity—he really did not know what other word to use—of the London County Council, in presuming, in the first instance, to give absolute instructions to Arbitrators with reference to what they were to do. They were to ignore everything that was in the interest of the Water Companies, and to give full weight to everything that might be brought forward against them. It was perfectly clear that the Water Companies had done an immense deal for London; and what they had done, had been under the authority of Acts of Parliament. As regarded their own Company, they only had a moderate return for the many years they had been in existence; and to ask the shareholders, who wished to keep their property, to take less interest than they were now receiving would be monstrous. It was not a question of the value of their undertaking as iron, pipes, and engines, but of the earning power of the Companies. Had the London County Council been willing to approach them with a fair offer, he did not think there was a Director who would have put any difficulty in the way. On the contrary, they would have done all in their power to facilitate the transfer of these properties, if it were thought desirable in the general interest, to a Water Trust, or even to the London County Council. He and the other Directors would freely admit that, if it had been found that they had been paying their dividends by neglecting their works and allowing them to get into disrepair, it might be said to them that they must take into consideration the expenditure necessary to put the works into proper condition; and if they had been paying dividends through not keeping their works in good order, fair allowance must be made for this, which would be a matter of arbitration. He hoped that the Water Companies would not assent to an amicable arrangement with the County Council that was not based on the income they had been fairly earning.

Mr. LOMAS asked whether the various Water Companies had agreed on common action in this matter. He thought if they could all be united on the question, it would be a very great advantage.

The CHAIRMAN, in reply, said he could hardly pledge himself positively; but he believed that it was pretty well understood that the Companies would act in unison. They were obliged for the suggestion regarding arbitration; and they would look into it closely. Whether they would be able to appoint Arbitrators or not, he could not say; but if they were appointed, he hoped they would be unfettered.

The motion was then put, and carried.

On the motion of the CHAIRMAN, seconded by Lord KNUTSFORD, it was agreed to pay the dividends recommended.

The CHAIRMAN then testified in warm terms to the services which had been rendered to the Company by the Secretary, with whom he was in constant contact; and he concluded by proposing an increase in Mr. Goodwin's salary from £600 to £700 per annum, to take effect from Michaelmas.

Mr. J. BEST seconded the motion, which was agreed to.

Mr. BAKER remarked that they must all be aware that in the last three years the Board, like the Directors of the other Water Companies, had passed through a most anxious and trying time in safeguarding the interests of the shareholders, and in seeing that they were not imposed upon by any would-be purchasers who might come along. He therefore thought that they might agree to award the Directors additional remuneration, especially when he told them that, on going through the reports of the other Companies, he had found that their own Directors were paid, he believed, the lowest of any. Not only had the Directors done well for them in the past, but they had anxious and important work to do in the future. He proposed that their remuneration should be increased from £2000 to £2500 a year.

Dr. LEESON seconded the motion; and it was carried.

Mr. BAKER remarked that there was one other point he would like to mention—namely, that the value of their property was mainly due to the initiative which the Directors took in promoting their grand scheme of water storeage, which obtained from the Royal Commission such an excellent report. Had it not been for this, he believed that that report would have been very unfavourable, and that the value of the Company's stocks would have been 30 or 40 per cent. lower.

The CHAIRMAN, in reply, said that they had been quite taken by surprise as regarded the resolution just passed; and he could only express, on behalf of the Directors, their great obligation for such recognition of their services. He must not speak for himself, but he would say for those who were associated with him that they had given very close attention indeed to the affairs of the Company.

Mr. I. A. CROOKENDEN added his testimony to what had been said regarding the loss sustained by the Company in the death of Mr. Whiting.

The CHAIRMAN, in reply, said they would have a difficulty in replacing their deceased colleague; but he thought they would be able to fix on someone—indeed, he had someone in view—who, if he could not bring Mr. Whiting's experience, would bring to their Board knowledge of a nature which would be very important to them in these troublesome times.

An Extraordinary Meeting was then held to sanction the raising of additional capital.

The SECRETARY having read the notice convening the meeting,

The CHAIRMAN said he thought they would not have been wholly unprepared for the notice which they had just heard read. At their last meeting, he stated that they had executed large works, that their resources were pretty well exhausted, and that they would have to

come before the shareholders for additional capital, if their works were to be maintained in perfect condition. The time had now come when fresh capital was required. He believed it was about four years ago when they asked for permission to raise £50,000 according to their Act of Parliament; and the money was obtained on terms very advantageous to the Company. They had thought it best now to ask the shareholders to give the Directors power to raise the balance of the sum they were entitled to call up by their Act of 1878—that was £100,000. They thought it better to have this authority now, as well as power to borrow the balance of the sum authorized by the same Act. It was thought advisable to do this at one meeting, instead of coming before them again. It need not, however, be supposed that they were going to raise £100,000, as well as the debenture money, right off. They had no intention of doing so, except as they required it. He then moved a resolution authorizing the raising of the remainder (£100,000) of the additional capital sanctioned by their Act of 1878.

Mr. J. BEST, in seconding the motion, said he thought they might fairly trust the Board as to the right time for raising the money, and the way in which it was to be spent.

Mr. SPICER thought it would be better only to call up the actual amount of capital required. If more were wanted six months hence, the shareholders could be asked again for their authority. He held this opinion while having perfect confidence in the Board.

Mr. TENDRON pointed out the advisability of dealing with the matter in the way suggested by the Directors. By having the powers now asked for, they believed they would be able to act most to the advantage of the shareholders.

Mr. R. A. M'LEAN thought the recommendation of the Board ought to be accepted. There was no better time for placing the shares for the money they might require; and he could easily conceive circumstances arising for getting money before their next ordinary meeting.

The resolution was then carried unanimously; and the proposal to raise the balance of the amount authorized to be borrowed by the Act of 1878 was also agreed to.

On the motion of Mr. FOX, seconded by Mr. BEST, a vote of thanks was passed to the Chairman, Directors, and staff.

The CHAIRMAN, having returned thanks, said that the Directors had already passed a resolution expressing their sympathy with the members of Mr. Whiting's family; and he was sure the Board would be glad to include the shareholders in this resolution, in accordance with the suggestion that had been made.

The proceedings then terminated.

THE PLYMOUTH CORPORATION AND THE GAS COMPANY.

The Testing of Gas.—The Fumes from the Gas-Works.

At the Meeting of the Plymouth Town Council yesterday week—the MAYOR (Mr. W. Law) presiding—various matters affecting the relation of the Corporation to the Plymouth and Stonehouse Gas Company came up for consideration. One of these was the proposal of the Works Committee, referred to in the last number of the JOURNAL, to pay Dr. Bean, the Borough Analyst, £40 per annum for testing the illuminating power, purity, and pressure of the gas supplied.

Mr. P. T. PEARCE proposed that this recommendation should be referred back to the Committee for further consideration. He contended that, whatever might be the result of the proposed tests, no practical advantage could accrue from them. At the gas-works, there was apparatus for testing the illuminating power, which the Corporation were entitled to use on giving 24 hours' notice; and they could test there as much as they pleased. Then the Technical School Committee had offered to do this work for nothing; and really he did not see what advantage was to be gained by paying Dr. Bean £40 a year. He understood the result of former tests was that they obtained no advantage at all. He hoped the Council would not waste this money.

Mr. C. H. RADFORD seconded the motion, and said the Photometrical Committee were wrong in placing the apparatus in the Guildhall, instead of accepting the offer of the Technical School Committee to place it in the Technical School, where there would have been no charge for these tests.

Mr. W. AXWORTHY asked whether they were to lock up the apparatus which they had purchased. It had cost, with the fitting up of the room, a sum of £700; and if it was not to be used, this sum would be wasted. He could not understand any member of the Council suggesting that money should be thrown away in this manner.

Mr. W. C. JAMES thought they could not judge the value of the tests by the fact that not much objection could be taken to the quality of the gas supplied. Perhaps the knowledge that tests were being made accounted for the gas being tolerably good. It was their duty, as a public body, to see that the town was supplied with gas of proper quality. If there was any cheaper way of doing it than the one now proposed, let them adopt the plan; but seeing that they had already decided upon a certain policy, and had erected the apparatus in the Guildhall, it was rather late in the day to talk of handing it over to the Technical School. It was very desirable—indeed, it was absolutely necessary—that the gas should be tested. In fact, if they only looked at the ceilings in their own homes, they could have little doubt that the gas was capable of improvement.

Mr. J. LITTLE thought the first loss was the best loss. Because they had already wasted a large sum of money, this was no reason why they should throw away £40 a year, when they could go to the gas-works and secure greater advantages.

Mr. A. R. DEBNAM remarked that everybody in the town had been complaining for years about the quality of the gas; and, in consequence of these complaints, a Special Committee was appointed by the Council to consider the matter. This Committee went to a large expense in obtaining and fitting up the apparatus; and now it was said that it was of no use. But it had never been tried. It was also suggested that they could go to the gas-works on giving 24 hours' notice; but this notice would enable the Company to clear out their stock of gas, and make everything right for the test. If the Company kept a six months' stock, there might be something in the suggestion; but the fact was that the quantity of gas in stock was limited, and a test after 24 hours' notice would be of little value, or would be simply a farce. It was true that, to get a prosecution of the Company, they must give this notice; but the importance of the Committee's proposal lay in the fact that they would have five tests weekly, and these would be directed to the quality, the pressure, and the illuminating power of the gas. They paid for meteorological observations; and surely they could not begrudge the money for these observations respecting the gas, which would tend to the direct benefit of the whole community.

The TOWN CLERK (Mr. J. H. Ellis), in answer to a question, ruled that shareholders in the Gas Company were not entitled to vote on the question before the Council, because they were pecuniarily interested in it. He added that every candle additional illuminating power cost the Company a certain amount of money.

Mr. Pearce's motion was then put, and defeated by 22 votes to 8.

Mr. RADFORD raised a further objection, as to the way it was proposed to remunerate the Borough Analyst for these services.

Mr. PEARCE repeated that the tests would be valueless. Dr. Bean could report every night that the quality of the gas was deficient; but it would make no difference, for the Company were not amenable to his tests or the Corporation's apparatus.

After some further remarks, the Committee's recommendation was adopted.

Mr. J. H. S. MAY, in moving the adoption of the minutes of the Sanitary Committee, alluded to the very influential deputation which waited on the Committee with reference to the nuisance caused by fumes from the gas-works. The Committee had since interviewed the Directors of the Gas Company, who expressed their intention to do all they possibly could to relieve the inhabitants of the district from the inconvenience to which they were subjected.

The TOWN CLERK read a letter from Mr. J. Thomas, the Company's Secretary, stating that the Directors had given instructions for certain works to be executed—and they were now in hand—which would, it was believed, obviate any reasonable ground of complaint. The Town Clerk added that he had prepared a case for the opinion of Counsel on the subject; and he was now disposed to think he was wrong in saying that the Council had no remedy in the matter.

THE NEWARK CORPORATION AND THE GAS COMPANY.

Contemplated Purchase of the Works.

A Special Meeting of the Newark Urban Sanitary Authority was held yesterday week, to discuss a report by a Committee who had been appointed to consider the desirability, or otherwise, of taking over the property of the Newark Gas Company, who are applying to Parliament for an extension of their powers as a limited Company. The Town Clerk read the minutes of the meeting of the Committee, which contained a resolution to the effect that they were of opinion that it would be advisable and beneficial to the interests of the town to approach the Directors of the Company with a view to purchase on reasonable terms. The Mayor (Mr. Doubleday) moved that the minutes be passed. He said that the resolution which the Clerk had read was unanimously agreed to by the Committee; and now they only waited for the permission of the Authority to go farther with the matter, and approach the Directors of the Company with a view to purchase. They had seen the Secretary (Mr. F. B. Foottit); and, with the permission of his Directors, he had supplied them with a good deal of valuable information as to income, &c. Taking these facts well into consideration, they felt strongly justified in recommending the Corporation to proceed on the course they had commenced. Mr. Norledge seconded the motion; remarking that there was a strong feeling in the town that these and other works should be under the control of the Municipality. Alderman Hole, in supporting the resolution, said they could place every confidence in so representative a Committee as that which had considered this matter. The resolution was then carried; only one member voting against it. It was afterwards agreed, on the motion of Mr. Norledge, that the Committee should be empowered to call in expert advice, and be allowed to pay any expense incurred in this direction.

Reductions in Price.—With the view of promoting the consumption of gas in the parish of Kirkby, the Sutton-in-Ashfield Local Board, at their last meeting, lowered the price by 3d. per 1000 cubic feet—the reduction to apply to the present quarter's accounts.——The Swanage Gas and Water Company announce that, as from the commencement of next year, the price of gas will be reduced to 4s. 2d. per 1000 cubic feet.——The Directors of the Altrincham Gas Company have decided to make a reduction of 3d. per 1000 cubic feet. The new rate, which will come into operation after Christmas, will be 3s. 1d. net.

Sewage Disposal at Teddington.—In a paper lately read before the Incorporated Association of Municipal and County Engineers, Mr. H. York described the works designed by him for the disposal of the sewage of Teddington. The sewage is charged with milk of lime, and then pumped up about 36 feet into a channel leading to the precipitating tanks; ferric alumina being injected into the rising main before the tanks are reached. The latter have a capacity of about 67,200 gallons each; and are adapted for either continuous or intermittent use. The effluent from the tanks is discharged over a filtration area of 6¾ acres, the under-drains of which terminate in a 15-inch stoneware pipe emptying into the Thames. The buildings at the works contain the air-compressing machinery for working the Shone ejectors on the sewerage system, a small electric lighting plant driven by an arrangement of pulleys from the pumping-engine, and a duplicate sewage-pumping and sludge-compressing plant. The works are designed to treat the sewage of 30,000 people; but at present only 5200 are connected with the sewerage system. The machinery was started about a year ago; and it has run twelve hours a day only until recently. Continuous pumping is now maintained; and this is found to be more satisfactory.

ELECTRIC LIGHTING NOTES.

As mentioned in last Tuesday's issue, the Brighton Town Council had before them on the previous Thursday a special report by the Lighting Committee, recommending a considerable extension of the electric lighting works, at a cost of £42,900. In justification of this large additional outlay, the Chairman of the Committee (Mr. Stafford), referred to the outcome of the working of the installation since its commencement in 1891; the figures which he quoted being net results, after all deductions for bad debts, &c. He said that after only three months' running in 1891, there was a deficit of £283; in 1892, there was a net profit of £12, but in 1893, with a larger percentage of bad debts than usual, there was a net profit of £300. For 1894, the revenue for the nine months ending September reached the sum of £8464, as against £7800 for the whole of 1893. If to this were added the most productive quarter, which was about equal to all the other three, their revenue would, probably, for the year, exceed £14,000. It was impossible to say yet what profit they would make; but he would say that he thought the next balance-sheet would be a great surprise to those who had prophesied a large loss to the ratepayers in connection with the electric lighting. Regarding the proposed expense of the works, he said that at the present time they had about 5600 houses in the borough along their mains; and of these only 800 were connected—showing that an average of only one in seven were using the supply. These figures intimated at a glance the field that was yet open to them for expansion. The 800 buildings were made up as follows: 424 shops, 169 private houses, 9 churches, 61 hotels, clubs, and public houses, and 137 miscellaneous offices, &c. The number of applications received in the year to Dec. 3, excluding the old Company's customers, was 267, as against 226 in the corresponding period of 1893. The number of houses connected on Dec. 3, 1893, was 408; and on the corresponding date this year, it was 811—showing an increase of 403 customers. Of these 196 were taken over from the Company. The Committee were now considering the advisability of lighting by electricity some of the principal streets in the town. They believed this could be done very economically, because it would materially help in lowering the cost of production to the general supply. Concerning the works, the mains and plant had been overhauled during the year, and paid for from revenue; and they anticipated that, by maintaining everything from revenue, the whole undertaking would be bought and paid for by the sinking fund, or depreciation fund, which was put aside year by year. He congratulated the Council upon having adopted the buried cable system at the outset of the undertaking. Up to the present time, this system had been proved to be the very best, as many towns had found the culvert and pipe system troublesome from the accumulation of gas. Their mains, which were now laid in about fifteen miles of streets, had given practically no trouble this year. The Committee had confidence in asking for this additional capital; they were satisfied and confident that the undertaking was a thoroughly successful and established one; and, being self-supporting, it involved no risk to the ratepayers. At the conclusion of a long discussion, the report was adopted, with only one dissentient.

The County of London and Brush Provincial Electric Light Company, Limited, recently sought from the Devonport Borough Council their consent to an application which they propose making to the Board of Trade for the grant of a Provisional Order for empowering them to supply electricity in the town; but the Streets and Highways Committee, who considered the matter, were of opinion that it was not advisable that they should comply with the Company's request. This decision came before the Council for confirmation at their meeting last Thursday. A motion to that effect was moved and seconded; and it met with some opposition, chiefly from Mr. Rendle. That gentleman asked what chance there was of the Council applying for a Provisional Order to supply the town with electricity themselves, or to lease it to a Company, while the Streets Committee was constituted as at present. He took advantage of the opportunity for reproaching the Gas Company with supplying gas which, of late, had been of "fearful" quality; and urged that the Council should take into consideration the question of the purification of the gas. He proposed that the report should be sent back to the Committee. This was seconded by Mr. Hornbrook, who thought that there were, perhaps, too many gas shareholders in the Council; and he maintained that this question ought to be referred to a Committee, none of whom had the slightest interest in the Gas Company. Mr. Tozer expressed the hope that the matter would not be laid aside indefinitely, and that the Council would not allow the present "imperfect" lighting of the borough to continue. On the other hand, Mr. Waycott thought that the Committee had studied the spirit of the times—viz., that local authorities should possess all undertakings of this kind; and Mr. Gill (who is a shareholder in the Gas Company) hoped the time was not far distant when the Corporation would own not only the water supply but the gas. A subsequent speaker mentioned that the Gas Company were now testing incandescent gas-lights for outdoor illumination. Mr. Rendle was then induced to withdraw his amendment; and the Committee's decision was confirmed.

The inhabitants of Dewsbury can now rejoice in being in possession of an electric lighting installation, which, we are told, the Corporation have put down in self defence, as two private companies were endeavouring to get powers to provide electricity for the town. The mains were formally charged with electricity on Monday last week, when it was stated that the number of applications received for current was not large. The Consultiug Engineer (Mr. W. H. Preece) was present; and he gave the comforting assurance to the Corporation that the number of applications so far had reached to about the average, and that he did not know of a single case where electric lighting had not proved successful.

The Electric Lighting Committee of the Dublin Municipal Council is looking forward to a substantial increase in the revenue from private consumers of electricity in the coming year. Their estimated receipts for the current year under this head were £7218, as against which they calculate that they will receive £7417. The estimate of income for 1895 is £9712; and of profit, £3402.

The Fareham Local Board have applied to the Local Government Board for permission to borrow £7000 for the purposes of electric lighting, including the purchase of the undertaking of the Electric Light Company. Colonel J. T. Marsh, R.E., held an inquiry into the matter last Friday week, when several gentlemen spoke in opposition to the application.

Considerable commotion has been caused at Prescot by the action of the Local Government Board Auditor (Mr. G. Haslehurst) in surcharging four members of the Local Board to the extent of £360 in connection with the electric lighting of the town. The Prescot Wire Company had entered into a contract with the Board to light the town with electricity instead of gas. A local Solicitor (Mr. J. D. Banks) had complained of the inefficient nature of the new light, and further drew the attention of the authorities in London to the fact that there was no penalty clause in the contract, which rendered it invalid. Some of the members of the Board have espoused the cause of electricity, and others gas; and the controversy has waxed hot locally. Acting on several minutes in the Board's records that they did not consider the lighting efficient, the Auditor has surcharged four members—Messrs. Dyson, Berry, Preston, and Pennington—to the extent of £360, as they had signed cheques for payments to the Company to cover periods when the light was unsatisfactory. A petition is to be forwarded to the Local Government Board, to ask them to remit the surcharges.

We learn from a Liverpool paper that a disconcerting, though amusing, incident occurred at the last meeting of the Southport Town Council. The members were in the midst of a discussion on the minutes of the Gas Committee, when, without any warning, the electric light which "illuminated" the chamber went out, and the members were left in complete darkness. One of them lit a match, and jocularly requested a councillor who had been speaking to proceed with his observations. For a while no one attempted to move; but ultimately Mr. E. J. Harper, the Deputy Town Clerk, left the room, and on his return intimated that the fuse of the particular switch which lighted the chamber was out of order. The Mayor (Alderman Wood) observed that they were now shown the folly of doing away altogether with gas. He had protested against it from the beginning. It was eventually decided to adjourn to the Mayor's parlour; but when the majority of the members were descending the steps leading to that room, they were informed that the switch had been put right. They thereupon returned to the chamber. "I was endeavouring," proceeded the gentleman whose speech was interrupted, "to throw some light on the matter." But hardly had he uttered the words when the light again went out; and once more the room was in darkness. This time the members kept their seats; and after the switch had been repaired, the business of the Council was resumed.

MR. W. R. HERRING ON GAS CONSUMPTION.

In connection with a local Church Association, Mr. W. R. Herring, the Gas Engineer of the Huddersfield Corporation, recently gave an interesting lecture on "Gas Consumption: How to Burn and How to Save Gas." Mr. Herring began by giving an historical account of the progress of artificial illumination; closing this part of his lecture with a reference to the introduction of coal gas by Murdoch in 1792, and its adoption in London, to the exclusion of the old oil-lamps, early in the present century. Since that time, he pointed out, there had been a constant demand for more light; and what was considered as sufficient a few years ago was certainly not so regarded now. He then went on to remark that the problem was how this increase of light could be secured without also raising the cost. Assuming that the same quantity of gas was capable of yielding more light, what, he asked, were the causes which prevented consumers generally from having satisfactory lighting in their houses. The fault rested, in the majority of cases, he said, with the gas-burners being old or unscientific in principle; or it might be that the pipes in the houses were inadequate in size, or were choked by corrosion, so that it was impossible to get a sufficient supply of gas. It might also be that the meter was defective, giving rise to temporary inconvenience. A very general cause of defective meters was overwork. Mr. Herring proceeded to explain the difference between wet and dry meters, and also the method of detecting leaks by the meter. He showed that mixing from 1 to 5 per cent. of air with gas was detrimental, because it would reduce the light; and that if this percentage was increased, it became highly dangerous up to 15 per cent., as it produced an explosive mixture. If a still greater amount of air was added, it made the Bunsen flame, which was practically the basis of all varieties of gas cooking and heating stoves. By means of experiments, Mr. Herring showed the nature of gaslight, and pointed out, that to get the greatest amount of light from the gas it was necessary to burn it in small jets, or to distribute it in a thin sheet, so that the atmosphere could come into proper contact with the gas issuing through the burner. He described the Argand burner, and the air supply, regulated by the chimney; and he pointed out that, in order that the thin sheet of flame might be of proper form and size, it was absolutely necessary that the gas should issue from the burner at a fixed pressure, any alteration of which must of necessity affect the appearance of the flame, as well as the quantity of gas passing. Herein, he said, lay the secret of efficient gas lighting. Again by experiment he showed that the rate at which the gas issued from the burner had a direct influence upon the amount of light and the consumption of gas. The lower the pressure, consistent with the giving of a properly shaped flame, the better the light, and the less would be the consumption. For this reason, the slit burner gave in practice better results than the union-jet, as it was easier to see when an excess of gas was passing the former than the latter. But if the slit burner were allowed to become dirty, or the proper material was not used in making it, the surface became roughened, and offered resistance to the passage of the gas, which caused a diminished lighting effect. Mr. Herring next referred to the advantages attending the use of governor burners. He then passed on to speak of the discoloration of ceilings, about which consumers complained; and he said coal gas was not responsible for this trouble—which could never be entirely prevented—if it was properly burnt. Having shown how a good light might be depreciated by the use of an improper globe, the lecturer gave his audience some particulars of the incandescent gas-light, and also described its

production. He stated that the consumption of gas by these burners depended upon the pressure, the same as in all burners, and beyond 15-10ths it became noisy, and gave a warning of excessive consumption. He found that a "Class C" incandescent burner at this pressure passed 4·775 cubic feet of gas, and gave a light of 89·465 candles, or 18·73 candles per foot of gas—this being about five times as great as the same quantity of gas yielded when burnt in a standard Argand burner at the rate of 5 cubic feet per hour. He gave a table showing the consumption of gas at various pressures with a "C" burner, and said that, as far as lighting went, the best results were obtained when the pressure was at 15-10ths, for anything above this was non-effective, and even detrimental. On the other hand, a decrease of light was also noticeable with the lesser pressures, and consequently smaller consumptions. He was not, however, prepared to advise his audience to use these burners at 15-10ths pressure, as probably the consumption of gas would depreciate the mantle in greater proportion than a consumption at from 9-10ths to 12-10ths. The fact of having these burners was no guarantee as to the consumption of gas, as this depended entirely on the pressure in the pipes. If the suppliers of this class of burner were wise, they would, in their own interests, attach a governor to each burner, to pass (say) 3½ to 4 cubic feet of gas per hour; in fact, purchasers should insist upon it—the price charged being sufficient to cover it. He expressed the opinion that this system would have a very serious influence on the adoption of the electric light; and he stated that in London it was displacing it, simply on the question of expense. He gave a comparison of the cost of illumination by electricity, coal gas, and the incandescent light, on the basis of a consumption of 5 cubic feet per hour; showing that ordinary gas was 2½ times less expensive than the electric light, and that the comparison was in favour of the incandescent light. At the close of the lecture, which was made exceedingly interesting by practical illustrations of the points raised, a hearty vote of thanks was accorded to Mr. Herring.

THE LONDON COUNTY COUNCIL AND THE WATER COMPANIES' UNDERTAKINGS.

Sanction to the Promotion of the Transfer Bills.

At the Meeting of the London County Council last Tuesday—Sir J. HUTTON in the chair—the Parliamentary Committee reported that they had proceeded on the resolution of the Council passed on July 3 last, instructing them, in conjunction with three members of the Water Committee, to prepare eight separate Bills for the acquisition by the Council of the undertakings of the eight Metropolitan Water Companies. The matter being one that required special and undivided attention, the Committee referred it to a Sub-Committee, on which members of the Water Committee and two members of the Finance Committee served; and for some months the Sub-Committee had been engaged in the preparation of the Bills. These they had now submitted; and the Committee were quite satisfied, from the explanations given, that their general principles were such as they could advise the Council to approve. The Committee added that no specific instructions were given by the Council in the resolution directing them to prepare the Bills; but they had assumed that the lines indicated in the resolution of the Council on the 27th of February last were, broadly speaking, those on which they were required to frame the Bills. They had directed copies of the Bills to be circulated to the Council; and they recommended—"That the eight Bills, entitled Lambeth Water-Works (Transfer) Bill, Southwark and Vauxhall Water-Works (Transfer) Bill, Kent Water-Works (Transfer) Bill, East London Water-Works (Transfer) Bill, New River Water-Works (Transfer) Bill, Grand Junction Water-Works (Transfer) Bill, West Middlesex Water-Works (Transfer) Bill, and Chelsea Water-Works (Transfer) Bill, for the transfer to the Council of the respective undertakings of the eight Metropolitan Water Companies, be approved; that the seal of the Council be affixed to petitions for leave to bring in the Bills; and that the Bills and petitions be deposited, pursuant to the Standing Orders of Parliament, with such necessary alterations (if any) in the Bills as the Parliamentary Committee may consider desirable."

Mr. BASSETT HOPKINS moved the adoption of the report.

Mr. CAMPBELL, while accepting the principle that the water supply should be under municipal control, objected to the mode of procedure suggested in the recommendation. He considered that it would be very much better for the Council to attempt to buy up only one of the water undertakings, and then proceed on the experience gained by that. It would, he thought, be well to see if they could get one Bill through before they pushed on with the others. He therefore submitted, as an amendment—"That, in the opinion of the Council, it is expedient that only one of the Water Bills should be proceeded with at present."

Alderman BEACHCROFT seconded the amendment. He said all sections of the Council were, he believed, in favour of the undertakings of the Water Companies passing into the hands of a central authority; but there was a great divergence of opinion as to how the transfer should be carried out. The Bills proposed that the question of price, instead of being settled in the ordinary way, should be referred to three Arbitrators—one to be appointed by the Companies, one by the Board of Trade, and one by the Council. He did not object to this; but he certainly did object to the next proposal, by which the Arbitrators were to be bound, in arriving at the fair value of the undertakings, to take into account the probable necessity of the introduction of a new source of supply and new and improved works. If this was to be a direction to the Arbitrators, there ought to be a corresponding direction to take into account profits that would arise from the expenditure of more capital and the introduction of new machinery and works. If they acquired the water undertakings at a cost of £30,000,000, there would be an addition of 4d. at least to the rates. He characterized the proposal as one of worsement without a tinge of betterment.

Colonel FORD contended that the question would be greatly advanced if the Council secured a supply of sea water for sanitary purposes in London. Nine-tenths of the water at present supplied was not used for drinking purposes, but for watering streets and flushing sewers.

Mr. WESTACOTT appealed to the Council not to accept the amendment. He said if the eight Bills were all introduced together, there would only be one fight before a Committee of the House of Commons; and if the Council only introduced one Bill, it was sure to be said that they had tried to get hold of one Company only, whereas they ought to have brought in Bills dealing with the undertakings as a whole.

Major PROBYN supported the Committee's proposal, and quoted from the Bills to show that Alderman Beachcroft was mistaken in saying that the terms of reference to the Arbitrators were not fair and equitable. In fact, he (Major Probyn) was prepared to say they were "too fair."

Mr. LLOYD having expressed his intention of supporting the Committee,

A vote was taken on the amendment; and it was rejected.

Mr. BASSETT HOPKINS then explained that the Bills, after reciting the present state of the water authorities, provide in the first place for the Council and Companies entering into an agreement, each bearing a portion of the cost, for the transfer of the various undertakings to the Council. He said it was generally felt that the Companies would not agree to a transfer at the price the Council would be prepared to give; but the Committee felt that at least the Companies should be afforded an opportunity of negotiating. Failing such agreement, the Bills provided that Parliament should say that the undertakings were to be transferred, after certain dates, to the Council, upon terms which were provided for in the remaining portion of the Bills. These terms took the form of arbitration by three Arbitrators. There were several questions, apart from the terms of purchase, which would have to be decided. There was the question as to how far some of the present charges were legal, and as to whether some of the Companies were not acting illegally in taking from the Thames more water than their Act specified. Originally, the various supplies in London were begun as competing supplies; but since then the Companies had come to a mutual agreement. The result was that they found the Lambeth Company charging twice as much as the West Middlesex Company in a district which originally was under the supply of the latter Company. It was a question as to whether this, in itself, was not illegal; it was certainly immoral. The Bills further contained provisions for dealing with the servants of the Companies, as well as for negotiating with the Municipal Authorities in Greater London—whether County Councils or Local Boards—which were also supplied by the Companies. The Council had to remember that not one of the eight Companies supplied London alone. They all covered one or more districts outside London. What the Council wanted was to meet the views of these outside authorities, because their interests were identical.

Mr. WESTACOTT contended that the Council could only hope secure the undertakings by paying full compensation.

Mr. CAMPBELL moved that, instead of an Arbitration Board of three, a tribunal of seven be appointed, consisting of one representative from the County Council, another from the Water Companies, and five to be appointed by Government.

There was no seconder to this amendment; and consequently it was not put.

The Bills were then considered clause by clause, and approved; and the recommendations of the Committee were adopted.

The Dewsbury and Heckmondwike Water Scheme.—Last Thursday, the Dewsbury and Heckmondwike Water Board considered the draft of the Bill they are promoting to borrow £190,000 for the construction of reservoirs and acquiring a further catchment, and it was approved—the division or apportionment between the two townships being; Heckmondwike, £49,000; Dewsbury, £141,000. The amount covers not only the proposed works, but some already in course of execution.

The Moneton (New Brunswick) Corporation and the Gas and Water-Works.—The Corporation of Moneton (New Brunswick) being desirous of acquiring the gas and water works, the question of the price to be paid for them was submitted to the arbitrament of Messrs. R. Surtees, W. Shanly, and F. T. Holt. The engineering expert for the Corporation was Mr. Willis Chipman, of Toronto; Mr. M. M. Tidd, of Boston, representing the Company. We learn from *Engineering Record* that the Corporation contended that they should only pay a sum equivalent to the cost of a new plant, less the depreciation; while the Company claimed that the compensation should be based on the net earning power of the plant, capitalized at 4 per cent., with an allowance for prospective profits for the next ten years. The Company wanted $800,000; and the Corporation believed $208,000 was enough. The award of the Arbitrators (Mr. Shanly excepted) gives the Company $265,000 for the water-works, and $78,000 for the lighting system—a total of $343,000, which is $62,000 more than the cost of the plant as furnished by the Company's construction account. These figures are given on the authority of Canadian papers.

Plymouth Corporation Water Supply.—The Plymouth Borough Council had before them yesterday week a short report by the Water Committee, in which it was stated that the water revenue for last year amounted to £15,075. It also mentioned that Sir Massey Lopes had withdrawn his demand for arbitration, and accepted the terms of the Corporation in respect of the easements taken for the conduit from Burrator to Roborough, and of the coppice and timber removed from the site of the reservoir at Burrator (see *ante*, p. 745). Mr. J. T. Bond, in moving the adoption of the report, said that the water-rate accounts for the year 1893 were now closed. They showed that, while in 1892 there was a loss through voids, &c., of £3 3s. 7d. per cent., of the amount collected, last year the loss was only £2 18s. 11d. per cent. The net gain of the department in the twelve months was £827; and as the anticipated increase of revenue was only £400, this return was exceedingly gratifying. Diagrams had been prepared by the Water Engineer showing the consumption of water in 1891 and 1894. In the former year, it was 5,184,000 gallons per day; and this year it was 4,018,000 gallons. As the consumption had increased by 250,000 gallons, the waste had decreased by 1,500,000 gallons per day. The Committee, he further remarked, had agreed with the Saltash Corporation for the supply of water to that borough. The minimum guaranteed revenue from that source was £133 for the first three years, and after that period it would be £218. The motion was adopted.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Falkirk must still be the principal theme with me. A very important stage has been passed this week. Not only did Lord Low hear Counsel, and dispose of the fourth litigation which has arisen since the passing of the Falkirk Gas Act in August last, but an attempt was made to settle the dispute; and that having failed, it has been resolved that the arbitration is to go on. Accordingly, on Tuesday the arbitration proceedings will begin in Edinburgh, before Mr. Stevenson and Mr. Corbet Woodall, with Mr. Barr as Oversman. As will be seen in another column, Lord Low declined to interdict Mr. Barr, though he passed the note, and sent the case for trial. This enables Mr. Barr to act; but his acting is, of course, subject to the condition that, if the Corporation are successful in the action for reduction of his appointment, which they have served, the whole proceedings will be set aside. Counsel were heard upon the new application for interdict on Thursday; and Lord Low gave his decision on Friday. After the hearing on Thursday, there was a fear in the minds of the Corporation representatives that his Lordship might go against them; and consequently they made overtures for a settlement before the decision was given. The proposal was that the Gas Company should consent to Mr. Barr resigning—which was made in the belief that the Company had the power to retire Mr. Barr if they liked—and that then the Company should submit to the Corporation the name or names of gentlemen whom they were prepared to recommend for the post of Oversman. The proposed arrangement fell through, because it was impossible to get the Directors of the Gas Company together to consider it until after Lord Low's decision had been given. They were present in Edinburgh at the disposal of the case, and afterwards held a meeting to consider the situation. Prior to their meeting, however, a consultation took place between the agents of the parties, at which an endeavour was made to come to an understanding as to the substitution of an Oversman for Mr. Barr. I understand that where they differed was as to the nature of the man to be appointed in his place. The Gas Company were desirous of having a practical man, while the Corporation wished that a lawyer should be selected. After their meeting, the Directors stated that they would agree to the arbitration being postponed until the issue of the reduction, on the condition that if the reduction were successful the arbitration would begin *de novo*, but that if the Corporation failed, the arbitration should proceed as at the point of the nomination of Mr. Barr, with Mr. Barr as Oversman. This offer was declined by the representatives of the Corporation in Edinburgh; and arrangements were made for the arbitration to go on. In the evening, the Lighting Committee of the Corporation met in Falkirk; and it is announced that they agreed to allow the arbitration to proceed. They were, indeed, powerless to prevent it—the Court having refused to stop Mr. Barr acting. It is a pity that such a situation should have arisen; but while everyone must regret its existence, there will be a general feeling of satisfaction if Mr. Barr, who has been the innocent cause of all the trouble, should be able to vindicate his position by the issue of an award that will be unchallengeable. By this time next week, we shall know a good deal more than we do now regarding Mr. Barr's attitude, and also as to the affairs of the Falkirk Joint-Stock Gas Company. Three days are set apart for the hearing; but it is not likely to conclude in that time.

A curious occurrence took place in the Dalmarnock gas-works of the Glasgow Corporation on Thursday morning, between six and seven o'clock. A number of workmen were removing spent lime from the purifier-house, when, without anything to account for it, a light blue flame suddenly enveloped them. It came and went as suddenly as a flash of lightning, and made no noise. Unfortunately, seven of the workmen were burned about the face and hands; but it is satisfactory to know that none of them are seriously injured. The mysterious nature of the occurrence has been the occasion of a good deal of comment. Both Mr. Foulis, the Gas Engineer to the Corporation, and Mr. Manuel, the Works Manager, say they never experienced anything of the kind before. A piece of flint was afterwards found among the spent lime; and Mr. Foulis is of opinion that a spark had been caused by a workman's shovel coming in contact with it, which had ignited the gas that must have been present. This is possibly the only explanation which will ever be had of the affair.

Mr. Forbes Waddell, the new Corporation Gas Manager at Forfar, has prepared a report on the state of the plant in the gas-works. He states that, as the electric light has now been adopted in most of the factories in Forfar, the sale of gas under that head has steadily decreased from 7¼ millions in 1891-2 to 3 millions in 1893-4. Deducting, however, the gas sold to factories from the total sale, it is seen that there has been a steady increase in the sale to ordinary consumers. By carrying out what he proposed, he believed the Corporation would be enabled to sell gas much cheaper than at present; and consequently they would sell more of it. He thinks that a total of 35 million cubic feet per annum at the end of 12 years a very safe estimate to go upon, in reporting on the condition and working capacity of the present plant; and the proposals he makes are on this basis. With the exception of the retort-bench, purifiers, and holders, all the plant is of sufficient working capacity for the above-mentioned make, or can at a small cost be enlarged. With respect to the exceptions mentioned, he recommends that, in place of the present double bench, which contains 45 retorts, a single bench should be erected, containing 24 retorts—two ovens, with 6 retorts in each, on Hislop's patent regenerative system, to be erected as soon as possible, the remainder to be planned by the Manager, and erected later. He also recommends a coal-conveyor, by which coal could be taken direct from the railway siding to the retort-house stores. The cost of the bench and coal-conveyor would be about £1200. The annual saving which would be effected by this arrangement would be: Firemen's and labourers' wages, £200; extra sale on coke, £100; saving on coal account, £200—a total of £500. The covers of the present purifiers are entirely worn out; and it is absolutely necessary to have them renewed. The valve also requires refacing, which would cost £190; but, as an alternative, the Corporation are asked to consider the advisability of putting down a new set of purifiers, at a cost of about £1000. His reason for suggesting this is that, by having purifiers of large area, they would be enabled to produce gas of equal illuminating power from a much cheaper class of coal; and this he is certain would repay the first cost in a few years. Mr. Waddell also draws attention to the fact that the present holders are only capable of storing about 125,000 cubic feet, while the maximum daily make during the winter of 1893-94 was 150,000 cubic feet; and in view of this, he advocates the erection of a new holder. There is at present no provision made for protecting the oxide of iron from the weather; and as this is both a source of expense and inconvenience, he proposed to raise the roof of the present purifier-shed about 6 feet, and at its present level to have a spreading-floor. This would cost about £80, and would conduce to economy and more efficient purification. He also recommended the purchase of a photometer at a cost of about £80.

Mr. J. Kincaid, the Gas Manager at Peterhead, has reported to the Gas Committee that the gasholder accommodation at the works is not sufficient for the requirements of the town; and the Committee have requested him to prepare a report on the subject.

Mr. J. M'Gilchrist, of Dumbarton, has reported to his Gas Committee that it is necessary to provide increased storeage for gas; and the Committee recommended to the Town Council this week that properties in Castle Street should be demolished, and that a new gasholder of 120,000 cubic feet capacity should be erected on the site. An old holder, being considered unsafe, will be taken down. The necessity for an increase of storeage capacity arises, it is believed, from a steady increase in the consumption of gas for cooking and heating; and a still larger consumption is expected when a new railway station is erected. The Council agreed to go on with the work.

The Paisley Corporation have had before them plans by Mr. G. R. Hislop, the Engineer and Manager, showing how an installation for the manufacture of oil and water gas can be erected in the works; and the Committee were instructed to obtain offers for the work.

A share of the Montrose Gas Company was this week exposed for sale by public auction at the price of £45. An offer of only £20 was made, and the sale was adjourned. The Company's shares used to sell at an average of £50 each.

Sulphate of ammonia is down to £11 6s. 3d. per ton delivered in Glasgow. The reason of the decline in price is said to be the heavy stock which is held in London.

Mr. J. Wilson, Engineer to the Edinburgh and District Water Trust, has reported to the Arbroath Police Commission regarding their proposed augmentation of the town water supply. He states that, having had the water from the existing wells analyzed, the result is to show that it is very bad; there being no doubt that sewage gets into the wells. Instead of rebuilding the wells, which he considers would be difficult to do while the water supply is being taken from them, he suggests that it might be cheaper to take the water from an experimental well which the Commissioners have sunk, and then to drive a heading from that well through a water-bearing bed of gravel, below a seam of clay which would keep out the sewage from above. Even then he considers there might be risks of faults in the clay; and if houses were erected on ground around the well, there would be again, as with the present wells, a possibility of the contamination of the water in the well by sewage. He therefore suggests that the Commissioners should consider the advisability of endeavouring to procure a water supply by gravitation. The report was sent to a Committee for consideration.

Increased Use of Water-Gas Plant.—The water-gas plant, consisting of two complete sets, of 700,000 cubic feet per day total capacity, which Messrs. Humphreys and Glasgow have lately finished for the Tottenham and Edmonton Gas Company, have been successfully started; and the plant erected by them at the Garston station of the Liverpool Gas Company (the first installation of 2½ million cubic feet per diem) was to be put into operation last week. The Swansea Gas Company have arranged for two complete sets of plant, of a total capacity of 700,000 cubic feet a day; and the Brighton and Hove Gas Company, two sets of 1¼ to 1½ millions daily.

Sales of Shares.—The sum of £40,000 of new 7 per cent. stock of the *Liverpool United Gas Company* was offered for sale by public auction by Messrs. Branch and Leete, of Liverpool, last Thursday. There was a large attendance of buyers, who, judging from the briskness of the competition, appeared anxious to become possessed of some of the stock; but nevertheless there was not a great divergence in the prices realized. The £40,000 was divided into 400 lots of the nominal value of £100; and they produced from £168 to £170 each.——Last Thursday week, 20 £50 4 per cent. perpetual debentures of the *Exmouth Gas Company* were sold by auction at the gas-works, at prices ranging from £57 to £59 5s.; the whole producing £1162.——A few shares in the *Market Rasen Water Company* have lately changed hands at £13 10s. each.

The Condition of the Knaresborough Water-Works.—The Manager of the gas and water works of the Knaresborough Local Board has lately presented to the Gas and Water Committee his first report on the condition of the water-works. It is a long and carefully-prepared document, dealing with the course of the water from its intake to the point of consumption. Mr. Settle shows clearly that the plant is in anything but a satisfactory state; and he advises the expenditure of £1000 to £1200 on such appliances as he considers will enable the Board to furnish a constant supply of water to the town, and, moreover, commence clearing off their long-standing loan. He concludes his report by saying he has had a great struggle at the gas-works; but he is now alive to the fact that he has a still greater one with the water-works. The existing machinery not only offends his eye, but causes him much anxiety, as it is liable to break down at any moment. He points out that a town without light is a dismal place; but for one to be deprived of water is disastrous. He suggests that, if there is any doubt as to the accuracy of his remarks on the plant, a specialist in water engineering should be called in to further advise thereon. As the Board were near the end of their existence, it was decided that no action could be taken upon Mr. Settle's report. But a vote of thanks was accorded to him for it; and it was ordered to be printed and circulated.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 15.

Sulphate of Ammonia.—Prices are again lower this week; and it is hardly likely, under present conditions, that any immediate revival can be looked for. Some fairly large orders from consumers have been in the market. But the eagerness of sellers has, it is believed, prompted their withdrawal; and the lower prices, instead of proving an inducement to fill requirements, appear at the moment to exercise the opposite effect, and business on anything like a fair basis is almost impracticable. A portion of the accumulated stocks, recently referred to, has passed into consumers' hands; but apparently the quantity has not been sufficiently large to relieve the strain—at all events, it has not had any influence on prices. The closing values are very irregular at £11 5s. to £11 2s. 6d.

LONDON, *Dec.* 15.

Tar Products.—Pitch is distinctly easier, especially for forward delivery; but sales have been noted for next season's delivery at 34s. per ton. A considerable business is being done in benzols, though prices are not maintained. The best that can be obtained for either 90's or 50's is 1s. 1d. London, and ¼d. less for country ports. A fair business is going on in carbolic acid, but at easier rates; while crystals are flat, having fallen fully ¼d. per pound within the last month. "A" anthracene is firm at Committee's rates; but "B" anthracene does not improve. Business during the week has been done at the following prices: Tar, 18s. 6d. to 22s. 6d. Pitch, prompt, 38s.; forward, 34s. Benzols, 90's and 50's, 1s. 0½d. Solvent naphtha, 1s. 2½d. Toluol, 1s. 3d. Crude naphtha, 5d. Creosote, liquid, 2d.; ordinary, 1¼d.; salts, 20s. Cresylic acid, nominal, refined, 1s.; brown, 9d. Carbolic acid, 60's, 1s. 4½d. Anthracene, "A," 1s. 1½d.; "B," 10d.

Sulphate of Ammonia appears completely in the hands of "bear" operators. Prices continue to recede; and to-day's value may be taken at £11 to £11 5s. in all positions. For forward delivery, an advance of 5s. to 10s. is asked in all cases, less 3½ per cent., f.o.b., bags included; while gas liquor is quoted 6s. 6d. to 8s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The condition of the coal trade throughout this district remains without any improvement. Pits for the most part are not working more than about four days per week, with supplies largely in excess of requirements, and prices weak. The reduction announced at the commencement of the month, which was put in force by one of the leading Manchester colliery firms, has since been followed by other concerns in the district; and generally prices are below even the low rates which were ruling during the summer. The better qualities of round coal still meet with but very moderate inquiry for house-fire purposes. Best Wigan Arley only in exceptional cases fetches more than 10s. 6d. per ton. Pemberton four-feet and seconds Arley, 9s. 6d.; and common house-fire qualities, from 7s. 6d. to 8s. The lower qualities of round coal still meet with only a very slow demand, for ironmaking, steam, and general manufacturing purposes, with 6s. 6d. per ton representing about the full average figure at the pit mouth. Engine classes of fuel continue a drug upon the market, and exceedingly low in price. Common Lancashire slack is readily obtainable at 3s. to 3s. 6d. per ton at the pit; and better qualities, at 4s. 6d. to 5s. Slack from outside districts is offering at prices which do not leave more than 1s. 6d. to 2s. per ton at the pit mouth. The shipping trade remains in a very quiet condition, with prices lower, if anything. Common steam coal is readily obtainable, delivered at Garston Docks or the High Level, Liverpool, at 8s. per ton; better qualities averaging about 8s. 6d.

Northern Coal Trade.—The coal trade has become more irregular in the last few days, because there is the disturbance that the approaching holidays cause. There is a very large demand for gas coal; but manufacturing and household coal are far less in request than is generally the case at this season. Best Northumbrian steam coals are steadier than they were, as the shipments continue large, and the mild weather allows them to be got away readily. The price varies from 9s. to 9s. 6d. per ton f.o.b., according to the position of the colliery and the port of shipment. Second-class steam coals are about 6d. to 9d. per ton lower; and steam smalls are plentiful at from 3s. 6d. to 3s. 9d. Some of the steam coal collieries are still only working short time; but there is certainly a better demand from the East than there has been in recent winters. Manufacturing coals are dull; several large factories on the Tyne being already closed for the holidays, and thus reducing the consumption of this kind of fuel. Prices for next year's supplies are about 6d. per ton lower on the average than under the contracts that are now expiring. Gas coal is at the height of its consumption; and deliveries are large. The price of best Durham gas coal varies from 7s. 3d. to 7s. 9d. per ton f.o.b. Household coal is in limited demand; the mild weather lessening the use. Coke is only in moderate request—the exports being limited; but the local consumption is steady. The price is from 13s. to 14s. per ton f.o.b. Gas coke is fairly steady in price, when the large production is borne in mind. Some very large contracts for locomotive coal are now under negotiation, and will probably be settled at prices that are expected to be 6d. to 9d. per ton below those that they replace.

Scotch Coal Trade.—Dulness continues to prevail in the coal trade in Scotland. Orders are scarcer; and what business is offering is being eagerly competed for. Splint is abundant, with consequent prompt deliveries, and a tendency to lower prices. Steam coal experiences a slow demand. Ell is being most looked after, the reason for which is the near approach of the holidays, when it is expected little work will be done in the pits for a fortnight or three weeks. The north of Ireland trade has not returned to Scotland; English coal-owners being still able to hold it. The prices quoted are: Main, 7s. per ton f.o.b. Glasgow; ell, 7s. 9d. to 8s.; splint, 7s. 9d.; and steam, 8s. 6d. to 8s. 9d. The shipments for the week amounted to 152,088 tons—a decrease on the previous week of 11,559 tons, but an increase as compared with the corresponding week of last year of 88,646 tons. For the year to date, the total shipments have been 4,961,494 tons—a decrease, as compared with the corresponding period of last year, of 2,485,062 tons.

Water in Western Australia.—According to information lately received from Perth, Western Australia, water has been struck in the heart of Coolgardie by a private water company. It was met with at a depth of 157 feet, and is reported to be beautifully fresh. The supply was at first limited; but after three days' additional sinking, the water came in at the rate of from 50 to 60 gallons per day, and is increasing with depth. The Water Supply Department states that a similar supply of fresh water was struck in the Government well. The quantity there is also limited at present; but no doubt it will be increased by further sinking. The Hampton Plains Estate, which has a plentiful supply, has obtained quite a revenue from selling the water to Coolgardie. A big water scheme for Coolgardie is being mooted; and there is some chance of its being carried out. The proposal is to supply the town and the mines with salt and fresh water from Lake Lefroy. This lake is believed to hold enormous quantities of water—the bed being very much lower than the country all round; while the chain of lakes for miles drain into it. For domestic use, the water will be condensed and pumped into the town.

Concerts at the Midland Iron-Works, Donnington.—By permission of C. C. Walker, Esq., J.P., two concerts—one in the afternoon and the other in the evening—were given in Messrs. C. and W. Walker's workmen's dining-hall, in the Station Road, Donnington, on Saturday, the 8th inst. Mr. A. Featherstone, the General Manager, presided; Messrs. Howell and Palin being vice-presidents in the evening. The afternoon concert was arranged, in response to repeated requests, with the idea of enabling the general public as well as the employees to participate in the enjoyment of the music. The audience numbered upwards of 250. The evening entertainment was a smoking concert, at which between 600 and 700 workmen were present. Excellent programmes were drawn up for each concert; a special feature of the evening one being a topical song, entitled "Counsel's Opinion," composed and sung by Mr. R. J. Milbourne. It bristled with genial allusions to the members of the staff and the employees at the works; and it was very well received. The concerts, which were arranged by a Committee of Management of which Mr. W. W. Martin is the Organizer and Hon. Secretary, were highly successful. At the close, cheers were given for Mr. and Mrs. Walker; and Mr. Featherstone was thanked for presiding.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1160.)

Issue.	Share	When ex-Dividend.	Dividend on Div. Bonds.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	11 Oct.	10½	Alliance & Dublin 10 p. c.	10	19½—20½	+½	5 2 5
100,000	10	,,	7½	Do. 7 p. c.	10	13½—14½	..	5 3 5
300,000	100	2 July	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 4
220,000	5	14 Nov.	6½	Bombay, Limited	5	6½—6¾	+¼	4 16 5
40,000	5	,,	6½	Do. New	4	4½—5	+¼	5 4 0
380,000	Stck.	15 Aug.	11½	Brentford Consolidated	100	233—238	..	4 16 8
180,000	,,	,,	8½	Do. New	100	183—188	..	4 10 5
220,000	Stck.	28 Sept.	11	Brighton & Hove Original	100	217—222	+2	4 19 1
888,500	Stck.	30 Aug.	5	Bristol	100	115—120	..	4 3 4
320,000	20	28 Sept.	11½	British	20	48 49	..	4 11 5
50,000	10	30 Aug.	11½	Bromley, Ordinary 10 p. c.	10	21½—22½	..	5 2 2
51,510	10	,,	8½	Do. 7 p. c.	10	16½—17½	..	4 17 2
328,750	10	14 Nov.	2	Buenos Ayres (New) Limited	10	6—7	..	2 17 1
200,000	100	2 July	6	Do. 6 p. c. Deb.	100	101—103	..	5 15 5
150,000	20	12 July	8	Cagliari, Limited	20	27—28	..	5 14 3
550,000	Stck.	11 Oct.	13	Commercial, Old Stock	100	272—277	..	4 13 10
165,000	,,	,,	10	Do. New do.	100	200—2 3	..	4 17 7
160,762	,,	13 Dec.	4½	Do. 4½ p. c. Deb. do.	100	130—135*	+½	3 6 8
800,000	Stck.	13 Dec.	13	Continental Union Limited	100	237-24a*	+2	5 7 5
200,000	,,	,,	10	Do. 7 p. c. Pref	100	205—210*	+1½	4 15 3
535,000	Stck.	30 Aug.	5	Crystal Palace Ord. 5 p.c. Stk	100	115—120	..	4 3 4
486,090	10	27 July	11	European, Limited	10	22½—23½	..	4 13 7
354,060	10	,,	11	Do. Partly paid	7½	16—17	..	4 17 1
5,646,590	Stck.	15 Aug.	12	Gaslight & Coke, A, Ordinary	100	250—255	1 9	4 14 1
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	105—110	..	3 12 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	277—282	..	3 10 10
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200—205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	182—185	..	3 14 11
463,000	,,	,,	10	Do. I, 10 p. c. Prf.	100	275—280	..	3 11 5
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	,,	13 Dec.	4	Do. 4 p. c. Deb. Stk.	100	127—130*	+1	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	135—140*	+2½	3 4 3
908,000	,,	,,	6	Do. 6 p. c. do	100	188-192*	+2½	3 2 6
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	223—228	..	5 5 3
75,000	5	13 Dec.	6	Malta & Mediterranean, Ltd.	5	5—5¼	+¼	5 9 1
360,000	100	1 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	110—112	..	4 9 3
541,920	20	14 Nov.	5	Monte Video, Limited	20	15—16	..	6 5 0
150,000	5	29 Nov.	8	Oriental, Limited	5	7—7½	..	5 6 8
60,000	5	13 Sept.	7	Ottoman, Limited	5	4¼—4¾	..	7 7 4
166,870	10	31 Jan.	2	Pará Limited	10	1½—2	..	10 0 0
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	100—105	..	5 14 3
500,000	100	1 Dec.	6	2nd Do.	100	95—100	..	6 0 0
150,000	10	11 Oct.	6	San Paulo, Limited	10	8¾—9¼	..	6 9 10
500,000	Stck.	30 Aug.	15½	South Metropolitan, A Stock	100	337—343	..	4 10 8
1,350,000	,,	,,	12	Do. B do.	100	285—290	+2	4 2 8
260,000	,,	,,	13	Do. C do.	100	292—297	..	4 7 6
750,000	,,	12 July	5	Do. 5 p. c. Deb. Stk.	100	157—162	..	3 1 9
60,000	Stck.	30 Aug.	11½	Tottenham & Edm'nton, "A"	100	220—225	..	5 2 2
				WATER COMPANIES.				
746,011	Stck.	28 June	10	Chelsea, Ordinary	100	292—297	1 2	3 7 4
1,719,514	Stck.	11 Oct.	8	East London, Ordinary	100	232—237	..	3 7 7
654,740	,,	28 June	4½	Do. 4½ p. c. Deb. Stk.	100	152—156	..	2 17 8
700,000	50	13 Dec.	8½	Grand Junction	50	120—123*	+1½	3 9 1
708,000	Stck.	15 Aug.	12	Kent	100	305—310	..	3 17 5
1,043,800	100	28 June	9½	Lambeth, 10 p. c. max.	100	271—276	..	3 8 10
406,200	100	,,	7½	Do. 7½ p. c. max.	100	209—214	..	3 10 1
330,000	Stck.	28 Sept.	4	Do. 4 p. c. Deb. Stk.	100	132—135	..	2 19 3
500,000	100	15 Aug.	12½	New River, New Shares	100	385—390	+1½	3 2 2
1,000,000	Stck.	27 July	4	Do. 4 p. c. Deb. Stk	100	140—145	..	2 15 2
902,300	Stck.	13 Dec.	6	S'thwk & V'xhall, 10 p. c. max.	100	167—172*	..	3 9 10
126,500	100	,,	6	Do. D 7½ p. c. do.	100	160—165*	+3	3 12 9
1,155,066	Stck.	13 Dec.	10	West Middlesex	100	275—280*	+1	3 11 5

*Ex div.

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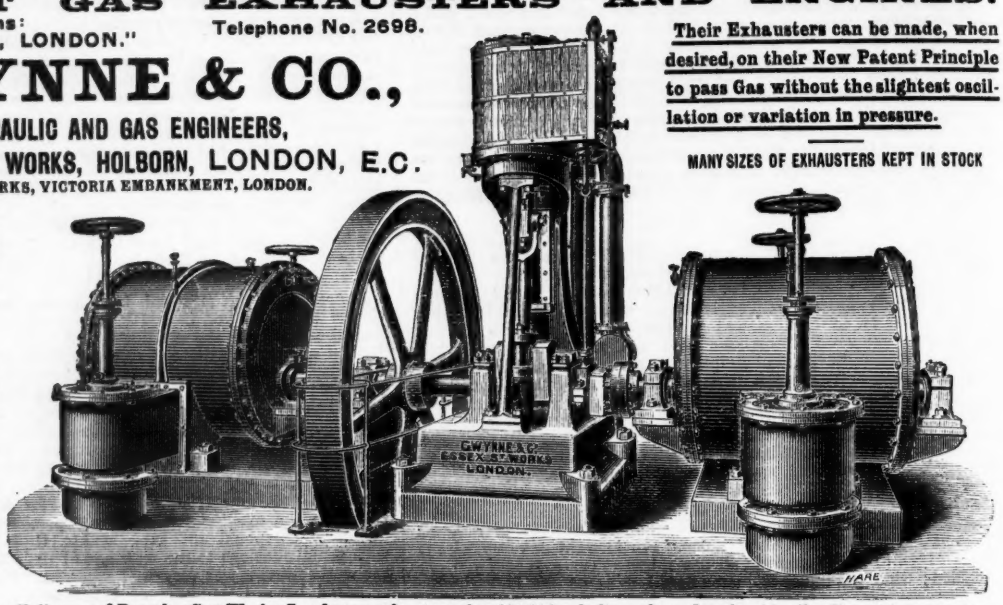

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CHRISTMAS HOLIDAYS.

NOTICE TO ADVERTISERS.—Owing to the CHRISTMAS HOLIDAYS, the next number of the JOURNAL will be published on MONDAY, the 24th inst.

Orders with respect to ADVERTISEMENTS must therefore reach the Office *not later* than the FIRST POST on SATURDAY, Dec. 22.

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GAS-FITTER.

WANTED, a Fitter for Indoor Work—Meter or Ironwork. One who has been in Gas Company's employ preferred. State References.
Apply, by letter, to No. 2465, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOREMAN Wanted, for Yard and Main and Service-Pipe Men. Must be a good Mechanic; understand Engines and Boilers; and have had Gas-Works experience. Wages 36s. per week.
Apply, by letter, stating Age, Experience, &c., to Mr. BRADDOCK, Manager, Gas-Works, Radcliffe, near MANCHESTER.

WANTED, a Clerk for the Hamilton Corporation Gas-Works Office. Must be steady, smart at Figures, and be able to prepare Working Returns, &c.
None but those experienced in such work need apply. Salary, 25s. per week.
Applications, stating Age and Qualifications, marked "Gas," to be lodged before the 22nd inst. with the Subscribers.

WM. POLLOK AND P. M. KIRKPATRICK,
Town Clerks.

Town House, Hamilton,
Dec. 11, 1894.

GAS MANAGER WANTED.

WANTED, by the Corporation of Clitheroe, a MANAGER for their Gas-Works, which produce about 30 Million Cubic Feet of Gas annually.
House, Coal, Gas, Water, and Rates free.
Applications, stating amount of Salary required, Age, present Occupation, and Experience in Gas Making, with recent Testimonials, to be sent to me on or before the 31st inst.
Selected Candidates whose attendance may be required will be advised by Letter.
Personal canvassing will disqualify.

JOHN EASTHAM,
Town Clerk.

Clitheroe, Dec. 13, 1894.

WANTED, Two Second-Hand Purifiers in good condition. Size about 6 ft. by 6 ft. by 4 ft. 6 in. deep.
State Price and Particulars to the undersigned.

WILLIAM TAYLOR,
Manager.

Gas-Works, Glossop.

TEN-HORSE Power "Trusty" Gas-ENGINE, by Weyman, FOR SALE. Cost £220 two years ago. Will be sold for half-price, to clear at once. Guaranteed in good working order.
Apply to W. BIRCH, HIGH WYCOMBE.

FOR SALE—Second-Hand Telescopic GASHOLDER, 60 ft. diameter by 10 ft. 6 in. deep each Lift, in Cast-Iron Tank.
Price and all Particulars on application to No. 2461, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SOWERBY BRIDGE LOCAL BOARD OF HEALTH.
(GAS DEPARTMENT.)

THE Gas Committee of the Sowerby Bridge Local Board of Health invite TENDERS for the purchase of the surplus TAR which may be produced at their Gas-Works, Sowerby Bridge and Luddenden Foot, from the 1st of February to the 31st of December, 1895.
Specification and Forms of Tender can be obtained by applying to Mr. John Marsland, Engineer and Manager, Gas-Works, Sowerby Bridge.
The Gas Committee do not bind themselves to accept the highest or any tender.
Tenders to be sent in not later than Monday, Dec. 24, 1894, endorsed "Tender for Tar," and addressed to the undersigned, Law Clerks to the Board.

GODFREY RHODES AND EVANS,
Solicitors,
Sowerby Bridge,
Clerks to the said Local Board.

Gas-Works, Sowerby Bridge,
Dec. 10, 1894.

PONTYPRIDD LOCAL BOARD (GAS).

THE Pontypridd Local Board invite TENDERS for the following:—
Contract No. 4—Sundry CAST and WROUGHT IRONWORK and STEELWORK required in the construction and erection of Columns, Girders, Beams, Roofing, Covering of Tar-Well, Retort-Bench Mountings, a set of Four Purifiers, Hydraulic Lifting Apparatus, Lime-Elevator, Centre and other Valves and Connections throughout the Works.
Contract No. 8—STEAM-ENGINE and GAS-EXHAUSTER.
Contract No. 9—STEAM-BOILER and MOUNTINGS.
Contract No. 10—TOWER SCRUBBER and TAR-EXTRACTOR.
Contract No. 12—STATION METER and STATION GOVERNOR.
The Specification and Drawings may be seen on application to the undersigned, and at the Office of Mr. Thomas Newbigging, C.E., 5, Norfolk Street, Manchester. Quantities and Forms of Tender may be obtained from the latter on deposit of Two Guineas, which will be returned on a *bond-fide* tender being received.
Tenders, endorsed "Gas-Works Contract No. 4, 8, 9, 10, or 12," to be sent so as to reach me not later than Noon on Wednesday, the 2nd day of January, 1895.
The Board do not bind themselves to accept the lowest or any tender.

By order,
H. LL. GLOVER,
Clerk.

Local Board Offices, Pontypridd,
Dec. 12, 1894.

ROCHDALE CORPORATION.

TO IRONFOUNDERS AND OTHERS.

THE Gas Committee of the above Corporation invite TENDERS for the supply of such quantities of CAST-IRON PIPES and SPECIALS of various sizes as they may require during a period of Twelve Months from the 1st of January, 1895.
Forms of Tender and any further Particulars may be obtained on application to Mr. T. Banbury Ball, the Manager at the Gas-Works.
Tenders, endorsed "Pipes," stating price per ton for each size of Pipes and Specials, delivered at Rochdale Station, must be sent in to me not later than Noon on Wednesday, Dec. 26, 1894.
Contractors who intend to sublet part of their contracts must forward with their original tender a List of the Names of their Sub-Contractors.

By order,
JAMES LEACH,
Deputy Town Clerk.

Town Hall, Rochdale,
Dec. 15, 1894.

ROCHDALE CORPORATION.

TO RETORT MAKERS AND OTHERS.

THE Gas Committee of the above Corporation invite TENDERS for the supply of such quantities of RETORTS and other FIRE-CLAY GOODS as may be required (exclusive of New Works) during the Year ending the 31st of December, 1895.
Forms of Tender and any further Information may be obtained on application to Mr. T. Banbury Ball, the Manager at the Gas-Works.
Tenders, endorsed "Fire-Clay Goods," must be sent in to me not later than Noon on Wednesday, Dec. 26, 1894.
Contractors who intend to sublet part of their contract must forward with their original tender a List of the Names of their Sub-Contractors.

By order,
JAMES LEACH,
Deputy Town Clerk.

Town Hall, Rochdale,
Dec. 15, 1894.

NOTICE.

TO GAS ENGINEERS AND OTHERS.

MESSRS. CLAPHAM BROS., Limited, Keighley, Yorkshire, are no longer authorized to Manufacture my CONDENSER and WASHER-SCRUBBERS.
The above-named Gas Apparatus are erected and giving entire satisfaction at the following places: Neath, Lincoln, Sheffield, Ellesmere, Mountain Ash, Malden, Cullingworth, Montreal (Canada), Woodstock (South Africa), Cape Town (South Africa), &c.
These Appliances can now be obtained solely of the undersigned.

J. A. KELMAN.

Winchester House, London, E.C.

Price 15s., Limp Cloth, the Fourteenth Yearly

ANALYSIS OF THE ACCOUNTS
OF THE
Metropolitan Water Companies,

Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex—showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand Gallons of Water supplied; the proportion of Expenditure and Profits to Gross Income; and the Income, Expenditure, and Profits per House, &c., supplied for the Year ended December 31, 1893, or March 31, 1894, together with the quantity of Water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the Year ended December 31, 1893.

Compiled and arranged by
ALFRED LASS, F.C.A.

LONDON: WALTER KING, 11, Bolt Court, FLEET STREET.

HARCOURT'S COLOUR TEST.

For Carbon Bisulphide, Sulphuretted Hydrogen, and Carbonic Acid in Coal Gas.

The Materials for the above Tests may be obtained from

Mr. S. E. MILLER, 115, Cowley Road, Oxford.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO.,

Central Plumbing Works, Town Hall Square, BOLTON.

Practical Makers of all kinds of Saturators, and Specialists in every description of Lead Work required in connection with Sulphate Plants.
Special attention to Repairs.
Seven Saturators placed with us the present Year.

HIGHEST REFERENCES ON APPLICATION.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE, OVER 4000 TONS.

LATEST ANALYSIS:—

Yield of Gas Per Ton . .	11,205 Cubic Feet.
Illuminating Power,	$16\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality)	$13\frac{3}{4}$ Cwt. Per Ton.
Sulphur	A little over 1 Per Cent.
Ash	Under 1 Per Cent.
Tar	163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor	103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE, 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . .	10,500 Cubic Feet.
Illuminating Power .	17 Stand. Sperm Candl.
Coke (of excellent quality) .	$13\frac{1}{2}$ Cwt. Per Ton.
Sulphur	1·13 Per Cent.
Ash.	1·34 Per Cent.
Tar	180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor	$94\frac{1}{2}$ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COAL-FIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

HEATHCOTE GAS COAL.

Rich in Illuminating Power & Yield of Gas.
Above the average in Weight & Quality of Coke.
Maintains a High Standard in Residuals.

THE GRASSMOOR Co., LD.,
CHESTERFIELD.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Bombay Gas Company, San Paulo Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.
8 Lombard Street,
NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

THE

STOVE FOR 1894-5.

THE KING OF STOVES

A SANITARY GAS-STOVE

Requires no Flue.

Guaranteed free from Smell and Fumes.

ADVANTAGES:—

1. Freedom from smell or fumes.
2. Great heating capacity.
3. Absolute safety. Can be placed on a carpet or near a wall. Recommended by Fire Insurance Companies.
4. Requires no flue; hence can be placed in any part of a room.
5. Heat under perfect control.
6. Absolute cleanliness.
7. Cheerful in appearance.

SUITABLE FOR

SHOPS, HALLS, OFFICES, CLUBS, SITTING-ROOMS, BEDROOMS, LIBRARIES, BATH-ROOMS, AND ALL DOMESTIC PURPOSES, ALSO FOR CHURCHES, CHAPELS, MISSION-ROOMS, ETC.

Send for Price List and Trade Terms to Manufacturers—

BROWN, MICHEL, & PAGE, Ltd.,
53, New Oxford Street, London, W.C.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

COKE BREAKERS.

G. R. Mather & Son, Engineers, Wellingborough

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."
WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE
BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET ADELPHI, LONDON, W.C.

TROTTER, HAINES, & CORBETT

Brettell's Estate

FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.

Available output up to 5000 tons per day,
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,

MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY.

Strongly recommended where EXCESSIVE HEATS have to be maintained.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

London Office:

90, CANNON STREET, E.C.

CLAYTON SON & Co., LTD., LEEDS

MAKERS OF

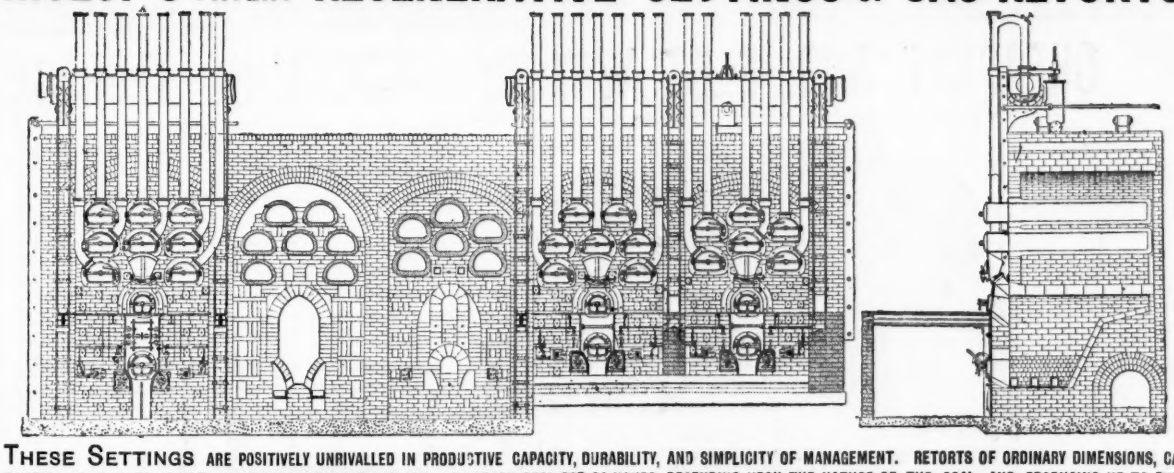
LARGEST GASHOLDER IN THE WORLD

ALSO THE LARGEST METAL TANK

See Advertisement last week, also next week

MAKERS OF RETORT-LIDS OF ALL FORMS & SHAPES BY SPECIAL HYDRAULIC MACHINERY

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS, CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings; or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Principal Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S Patents, all Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

THE

MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

Over 50 Maxim Patent Carburettors have now been fixed, capable of enriching

650,000,000

CUBIC FEET OF GAS PER DAY.

Among the Companies supplied are The Gaslight and Coke Company, the South Metropolitan Gas Company, Birmingham Corporation, Manchester Corporation, Rochdale Corporation, Bristol Gas Company, and many other Works, both large and small, where they have been working in some instances for the past **FOUR YEARS.**

More Gas and saleable Coke per ton of Coal Carbonized is produced; saving Capital, Labour, Fuel, Wear and Tear, &c.

The Enrichment is **INSTANTANEOUS** and **PERMANENT.**

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

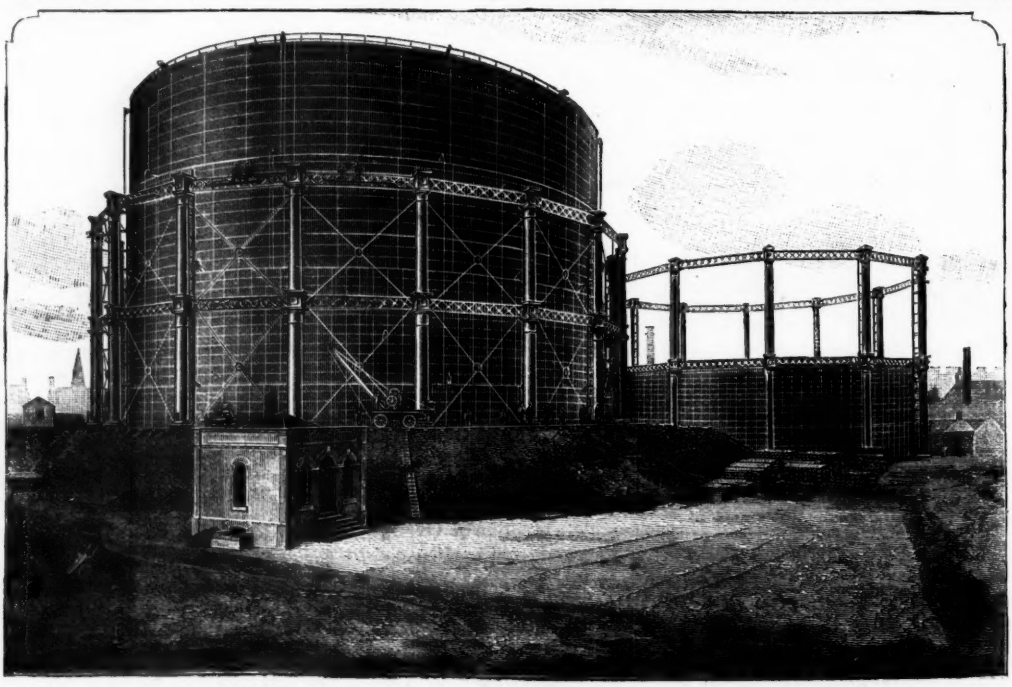
FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

Dealers in Carburine and all other Naphthas for the Enrichment of Gas.

THE CHEAPEST AND BEST WAY OF INCREASING STORAGE



From a Photo. of Four-Lift Holder at the Birkenhead Gas-Works, 160 ft. by 30 ft.

TWO LIFTS added to existing Holder on the ROPE SYSTEM, thereby doubling the Capacity.

NOTE—The Third Lift being controlled by Ropes as well as by the Columns, absolutely level working is assured.

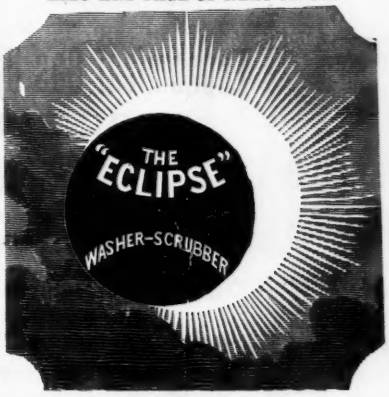
Patentees & Manufacturers **ASHMORE, BENSON, PEASE, & C° LD.,** STOCKTON-ON-TEES.

LONDON OFFICE: 15, VICTORIA ST., S.W.

HUNTER'S
OXIDE OF IRON.
JAMES HUNTER, MINER, AND SHIPPER OF
NATURAL IRISH BOG ORE.
This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.
Samples and Prices on application.
11, BAY STREET, PORT GLASGOW.
Telegrams: "HUNTER, PORT GLASGOW."
Established 1872.

COKE BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT.)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.
GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, E.C.,
And at STROUD, GLOUCESTERSHIRE.

SEE ADVT., p. 1144 OF JOURNAL FOR DEC. 11,
ALSO END PAGE OF NEXT ISSUE.



CLAPHAM BROS., Ld., Keighley, Yorks.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.
Prices and Analysis of all the Scotch Cannels on Application.

PIPES, 2-in. to 8-in.
2-in. to 8-in. **PIPES,**
PIPES.
MONIER-WILLIAMS & Co.
IRONFOUNDERS,
MIDDLESBROUGH.

R. DEMPSTER & SONS, L^D.

GAS ENGINEERS AND CONTRACTORS,

ELLAND, YORKS.

Established 1855. Telegrams: "DEMPSTER, ELLAND."

Engraved from Photograph of Complete Works erected by us in 1893.

The whole of the Apparatus, Foundations, Retort-Work, Buildings, and Levelling of Site have been executed by our men, without Sub-Contracts.

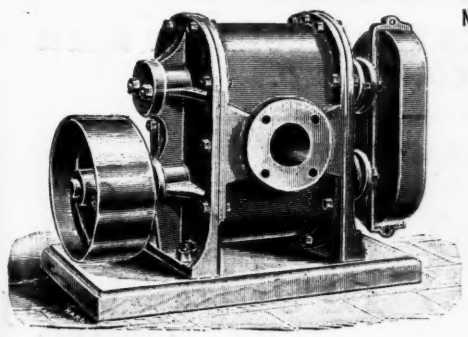
Estimates and Illustrations for complete Works, or for any detailed parts, supplied gratis on application.

Tenders given for all kinds of Structural Ironwork.

JOHNSON'S PATENT

DRUM PUMP AND GAS EXHAUSTER.

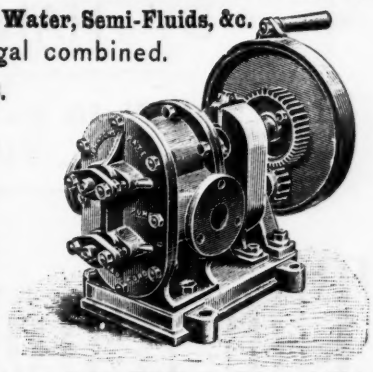
The Pump of the future for quickly and economically moving large bodies of Water, Semi-Fluids, &c.
The force of the Piston Pump with the capacity of the Centrifugal combined.



NO SLIDES OR FRICTIONAL WORKING PARTS.

NO PRIMING.

NO VALVES.



As supplied to H.R.H. the Prince of Wales for Pumping Gas Liquor at his Sandringham Gas-Works.

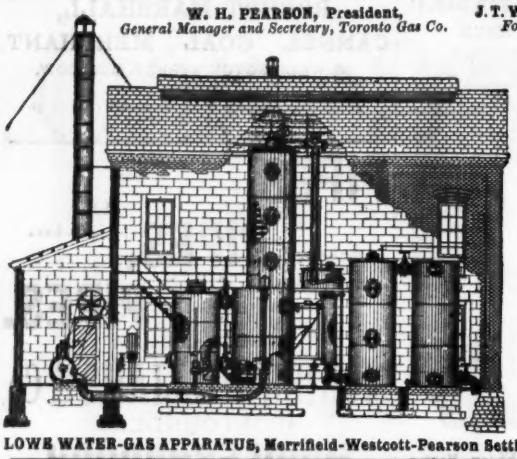
DRUM ENGINEERING COMPANY,

Hydraulic and Pneumatic Engineers, 55, ATHOL ROAD, BRADFORD.

W. H. PEARSON, President,
General Manager and Secretary, Toronto Gas Co.

J. T. WESTCOTT, M.E., General Manager & Treasurer,
Formerly Engineer for the United Gas Improvement Company, U.S.A.

L. L. MERRIFIELD, Chief Engineer,
Formerly Engineer for the United Gas Improvement Company, U.S.A.



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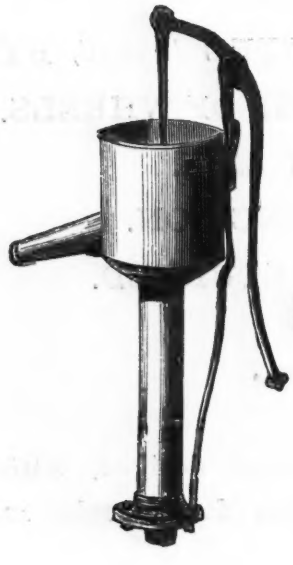

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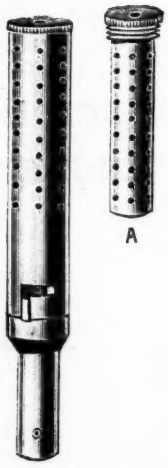

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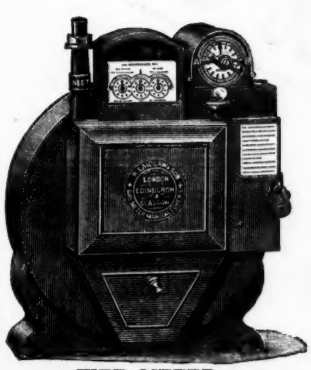

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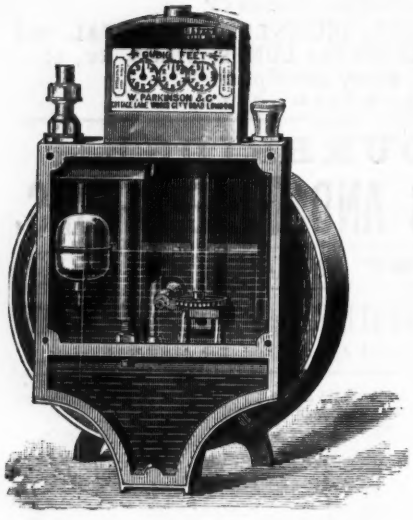

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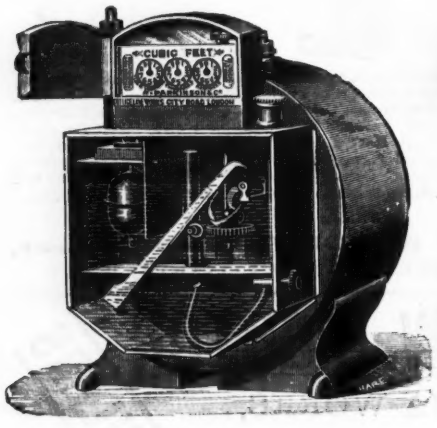

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[See also Advt., p. 1156.

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